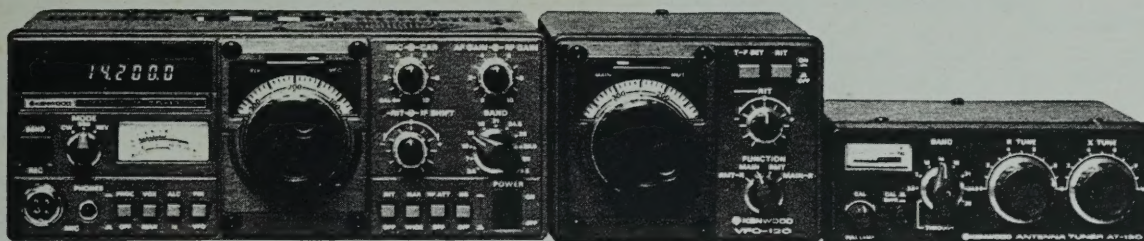




SERVICE MANUAL

TS-130S,V/VFO-120/AT-130

HF SSB TRANSCEIVER



TS-130 S

VFO-120

AT-130

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A product of
TRIO-KENWOOD CORPORATION
6-17, 3-chome, Aobadai, Meguro-ku, Tokyo 153, Japan

TRIO-KENWOOD COMMUNICATIONS, INC.
1111, West Walnut Street, Compton, California, 90220, U.S.A.
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TRIO-KENWOOD(AUSTRALIA)PTY. LTD.
30 Whiting Street, Artarmon, Sydney N.S.W. Australia 2064

SPECIFICATIONS

[GENERAL]

Frequency Range:

80 meter band	3.5 ~ 4.0 MHz
40 meter band	7.0 ~ 7.3 MHz
*30 meter band	10.1 ~ 10.15 MHz (10.0 MHz Receiving only)
20 meter band	14.0 ~ 14.35 MHz
*17 meter band	18.068 ~ 18.168 MHz
15 meter band	21.0 ~ 21.45 MHz
*12 meter band	24.89 ~ 24.99 MHz
10 meter band	28.0 ~ 29.7 MHz

Mode:

SSB/CW

Power Requirement:

TS-130S	TS-130V
RX: 0.7A 13.8V DC TX: 18A 13.8V DC	RX: 0.7A 13.8V DC TX: 4A 13.8V DC

Dimensions:

TS-130S	TS-130V
241 (9.6) W × 94 (3.8) H × 293 (11.7) D mm (inch)	241 (9.6) W × 94 (3.8) H × 235 (9.4) D mm (inch)

Weight:

TS-130S	TS-130V
5.6 kg (12.4 lbs)	4.9 kg (10.8 lbs)

[TRANSMITTER]

Final Power Input:

TS-130S	TS-130V
80 — 15 meter band 200 W PEP for SSB operation 160 W DC for CW operation 10 meter band 160 W PEP for SSB operation 140 W DC for CW operation	25W PEP for SSB operation 20W DC for CW operation 25W PEP for SSB operation 20W DC for CW operation

Audio Input Impedance:

500Ω ~ 50 kΩ

RF Output Impedance:

50Ω

Frequency Stability:

Within ± 1 kHz during the first hour after 1 minute of warmup
Within 100 Hz during any 30-minute period after warmup

Carrier Suppression:

Better than 40 dB

Sideband Suppression:

Better than 50 dB

Spurious Radiation:

Better than 40 dB

Harmonic Radiation:

Better than 40 dB

[RECEIVER]

Receiver Sensitivity:

0.25μV at 10 dB S + N/N

Image Ratio:

Better than 50 dB

IF Rejection:

Better than 70 dB

Receiver Selectivity:

SSB/CW WIDE

2.4 kHz (− 6 dB), 4.2 kHz (− 60 dB)

SSB NARROW

1.8 kHz (− 6 dB), 3.3 kHz (− 60 dB) with optional YK-88SN filter

CW NARROW

500 Hz (− 6 dB), 1.5 kHz (− 60 dB) with optional YK-88C filter

270 Hz (− 6 dB), 1.1 kHz (− 60 dB) with optional YK-88CN filter

Audio Output Impedance:

4 ~ 16Ω

Audio Output:

1.5 W

NOTE: Circuit and ratings may change without notice due to developments in technology.

* Will transmit on the new 30, 17, and 12 meter bands. Diodes installed for preventing accidental transmission before government amateur authorization.

CIRCUIT DESCRIPTION

Features added from former TS-120S,V are as follows;

1. The three new HF bands (receive only).

Band	Receive frequency
10	10.0~10.25MHz
18	18.0~18.5MHz
24.5	24.5~25.0MHz

(Note) Receives WWV on 10MHz.

2. 20dB RF attenuator

3. 2-position selectivity (receive only).

1) Optional filters available.

Optional filter	-6dB bandwidth
YK-88SN SSB narrow filter	1.8kHz
YK-88C CW filter	500Hz
YK-88CN CW narrow filter	270Hz

(Note) YK-88S (-6 dB bandwidth:2.4kHz) is installed at the factory.

2) -6dB bandwidth with various optional filters.

No.	MODE Filter	CW		SSB	
		WIDE	NARROW	WIDE	NARROW
1)	YK-88S only (installed at factory)	2.4kHz	*	2.4kHz	*
2)	YK-88C or YK-88CN	2.4kHz	500Hz or 270Hz	2.4kHz	*
3)	YK-88SN	2.4kHz	1.8kHz	2.4kHz	1.8kHz
4)	YK-88C or YK-88CN, YK-88SN	2.4kHz	500Hz or 270Hz	2.4kHz	1.8kHz

(Note) 1. *: No receive.

2. Jumper wire on the IF unit should be changed in No. 2 and No.4 Position.

3. YK-88S is always used in transmit.

5. AGC-type speech processor

Item	Rating
Center frequency fo	8830kHz
Center frequency deviation	8830kHz \pm 150Hz at 6dB
6dB bandwidth	\pm 900Hz or more
60dB bandwidth	\pm 1800Hz or less
Guaranteed attenuation	80dB or more within fo \pm 2.5kHz to \pm 1MHz
Ripple	2dB or less
Loss	3dB \pm 2dB
Input and output impedance	600 Ω /15pF

Table 1. SSB crystal filter (L71-0220-05)
YK-88SN (Option)

Item	Rating
Center frequency fo	8830.7kHz
Center frequency deviation	fo \pm 150Hz at 6dB
6dB bandwidth	\pm 250Hz or more
60dB bandwidth	\pm 900Hz or less
Ripple	2dB or less
Loss	6dB \pm 2dB
Guaranteed attenuation	80dB or more within fo \pm 2kHz to \pm 1MHz
Input and output impedance	600 Ω /15pF

Table 2. CW crystal filter (L71-0211-05)
YK-88C (Option)

Item	Rating
Center frequency fo	8830.7kHz
Center frequency deviation	fo \pm 50Hz at 6dB
6dB bandwidth	\pm 125Hz or more
60dB bandwidth	\pm 600Hz or less
Ripple	2dB or less
Loss	8dB \pm 2dB
Guaranteed attenuation	80dB or more within fo \pm 2kHz to \pm 1MHz
Input and output impedance	600 Ω /15pF

Table 3. CW crystal filter (L71-0221-05)
YK-88CN (Option)

CIRCUIT DESCRIPTION

SPEECH PROCESSOR CIRCUIT (X54-1550-00)

The AGC-type speech processor is composed of Q2: μ PC1158H2, Q3: 2SC1815(Y) and D3: 1N60.

The audio signal amplified by Q18 on the AF-GEN unit goes through diode switch D1:1S1555 to the MIC control when the processor switch is OFF. When the processor switch is ON the audio signal, which is compressed and gains talk-power by the speech processor circuit, goes through D2:1S1555 to the MIC control. Q1(V type) or Q11 (S type):2SK30A on the filter unit is cut off when the processor switch is ON to shorten the ALC time constant to increase the average RF output power.

TS-130 FREQUENCY SYSTEM

The TS-130 employs single conversion with a unique PLL circuit, as shown in Fig. 1.

The frequency system is basically that of the TS-820 with the exception of the PLL circuit.

PLL CIRCUIT

Fig. 2 shows PLL circuit construction and Table 4 shows the frequency in each circuit.

Referring to Fig.1, MIX (3) combines CAR and VFO signals and is operated straight through to mixer (1) on 3.5, 7 and 10 MHz. MIX (2) operates at 14 MHz and above with the output of MIX (3) to provide mixer (1) input, as shown in Table 4. MIX (1) output is filtered, amplified, shaped and divided by the programmable divider to obtain 500kHz output.

Band	RX.TX Frequency	VCO	MIX(1) Input	MIX(1) Output	Divider	D C B A
3.5	3.5 ~4.0	12.33 ~12.83	14.33 ~14.83	2.0	1/4	1 1 0 0
7	7.0 ~7.5	15.83 ~16.33	14.33 ~14.83	1.5	1/3	1 1 0 1
10	10.0 ~10.5	18.83 ~19.33	14.33 ~14.83	4.5	1/9	0 1 1 1
14	14.0 ~14.5	22.83 ~23.33	24.33 ~24.83	1.5	1/3	1 1 0 1
18	18.0 ~18.5	26.83 ~27.33	24.33 ~24.83	2.5	1/5	1 0 1 1
21	21.0 ~21.5	29.83 ~30.33	34.33 ~34.83	4.5	1/9	0 1 1 1
24.5	24.5 ~25.0	33.33 ~33.83	34.33 ~34.83	1	1/2	1 1 1 0
28	28.0 ~28.5	36.83 ~37.33	34.33 ~34.83	2.5	1/5	1 0 1 1
28.5	28.5 ~29.0	37.33 ~37.83	34.33 ~34.83	3.0	1/6	1 0 1 0
29	29.0 ~29.5	37.83 ~38.33	34.33 ~34.83	3.5	1/7	1 0 0 1
29.5	29.5 ~30.0	38.33 ~38.83	34.33 ~34.83	4.0	1/8	1 0 0 0

Table 4. The frequency chart

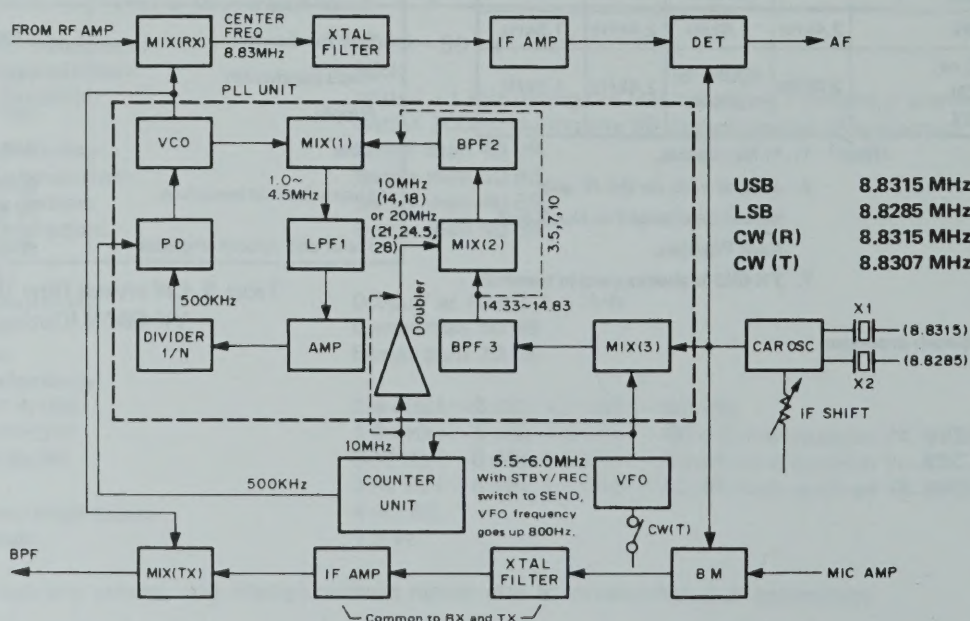


Fig. 1 TS-130 Frequency configuration

CIRCUIT DESCRIPTION

The programmable divider converts the information from the band switch into a BCD signal in the counter. By presetting, the signal is divided at the ratio shown in Table 4. The phase comparator is a Motorola MC4044P. The loop filter amplifier, component transistors, minimizes unwanted spurious signal. If output of the phase comparator unlocks for any reason, VCO output is switched off to prevent out of band emission and, simultaneously the digital display blanks

CAR OSCILLATOR

The CAR oscillator contains one oscillator and two crystals for LSB, USB and CW operation. The oscillator frequency in each mode is listed in Fig. 1.

Oscillator frequency can be varied by the IF SHIFT control during reception.

VFO OSCILLATOR

The TS-130 VFO has same circuit and gear ass'y as the VFO-830. An LED indicator for VFO and FIX operation has been added.

DIGITAL COUNTER

The TS-130 digital counter employs a VFO frequency counting system as shown in Fig.3.

The VFO frequency is mixed with a 5MHz signal obtained from the reference oscillator chain by a 3SK73 (Q7) and is converted to a 0.5MHz to 1MHz signal. This signal passes through the LPF, is amplified, buffered and shaped into a square wave, passes through the 0.1 second gate circuit and is applied to the 7-digit counter. The signal is counted from 10Hz to 10MHz.

The 100kHz, 1MHz and 10MHz order digits are preset by diode matrix operating on bandswitch information.

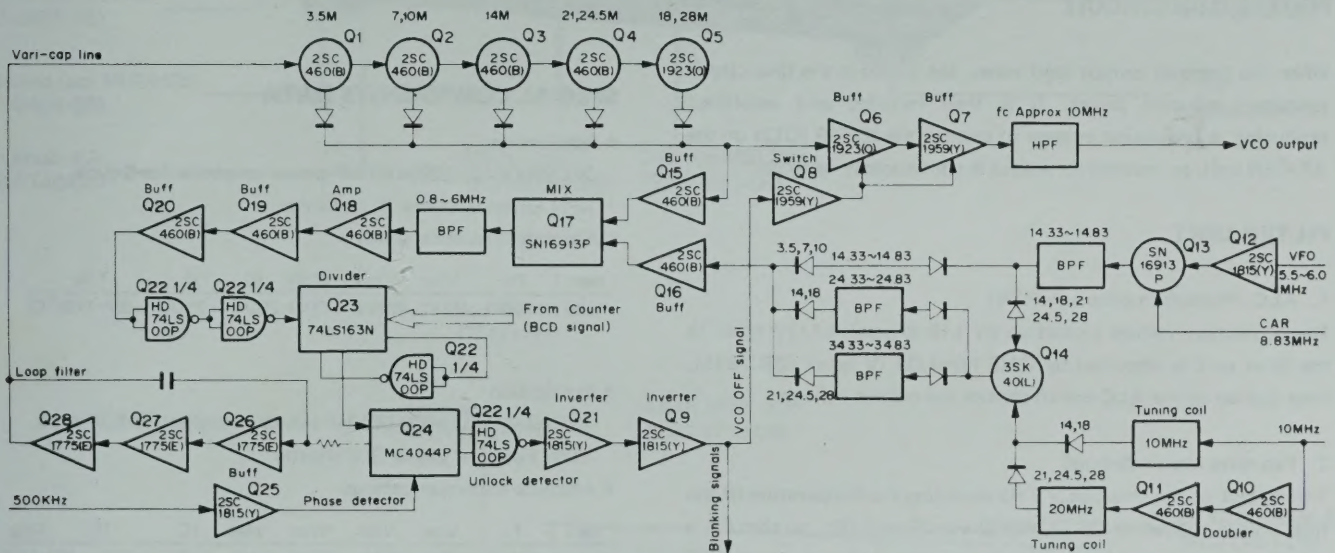


Fig. 2 TS-130 PLL circuit configuration

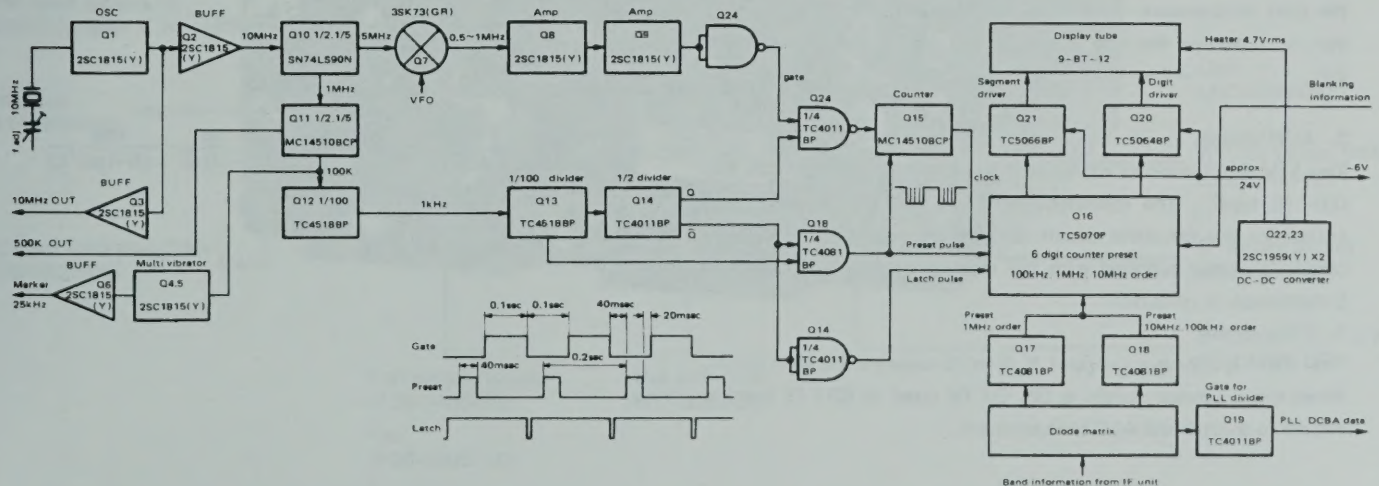


Fig. 3 TS-130 Counter unit block diagram

CIRCUIT DESCRIPTION/SPECIAL COMPONENTS DATA

The 10MHz signal from the time-base reference oscillator is divided to produce gate, latch, and reset pulses which are fed to the counter. The 10 MHz and 500kHz signals are fed to the PLL circuit.

The marker circuit produces a 100kHz signal which synchronizes the 25kHz multivibrator to obtain a marker signal as accurate as the reference frequency. The analog dial can be accurately calibrated to the marker signal.

The 1/10 division at the first-stage count-down chain uses low-power Schottky TTL, while the remaining divisions are made by a CMOS IC for low power consumption and minimum spurious emission.

Because of the IF SHIFT circuit, the CAR frequency is independent of the transmit/receive frequency. Once the VFO frequency is counted, the operating frequency is indicated as accurately as the 10 MHz reference oscillator frequency is calibrated to WWV. Operating frequency is indicated accurate to the 100Hz order, regardless of the band or mode.

PROTECTION CIRCUIT

When the transmit output load varies, the toroid in the final circuit samples reflected power. It is then rectified and amplified, producing a protection voltage to control the 2SK19 (Q12) on the AF-GEN unit, so transmitter output is continuously reduced.

FILTER UNIT

1. ALC : Protection circuit (VSWR)

The protection voltage picked up by L18 (S type), L11 (V type) in the filter unit is amplified by Q1 (S type), Q2 (V type) (2SC1815), then applied to the ALC line to control the output voltage.

2. Fan drive circuit (S type)

The output of the thermistor TH3 detecting the temperature of the final unit is applied to Q6 (2SA562) via Q7 and Q8, so that Q6 is switched to operate the fan. The fan starts to rotate at about 45°C although the operating range shown in specification is 30~60°C. It stops when the temperature drops to a level 5~15°C lower than the start temperature. This circuit operates regardless of transmission or reception because it detects the temperature of the heat sink.

3. AVR circuit

The 11V AVR consists of Q4, Q5 and Q6 (V type), Q4, Q5 and Q10 (S type). The regulated voltage is supplied to every unit except for the fan drive circuit during transmission. The fan drive circuit is always supplied with the regulated voltage regardless of transmission or reception.

4. Filter circuit

The filter is a 2-stage constant K filter (3-stage for 3.5 MHz band). When the processor switch is ON Q1 (V type) or Q11 (S type) is cut off to shorten the ALC time constant.

FINAL UNIT

1. Temperature protection (S type)

1. Core temperature protection

operates when the output transformer temperature exceeds 120°C. It recovers at approx. 80 to 110°C.

2. Operates when the heat sink temperature exceeds 90°C. It recovers at approx. 50 to 80°C.

When either of the above protection systems operate, the RL circuit in the AF-GEN unit is turned OFF and the unit is forcibly placed in the reception mode and transmission is inhibited. The protection circuit automatically recovers when the temperature drops to the normal level (i.e., the temperature drops by about 40°C).

2. Temperature detection by the fan drive circuit (S type)

The heat sink temperature is detected by the thermistor TH3 to control fan operation.

SPECIAL COMPONENTS DATA

• Applications

2SC2290 (V03-2290-06) HF power amplifier for S type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

Item	Pc	V _{CB0}	V _{CES}	V _{EB0}	IC	IE	Tstg
Value	175(W)	45(V)	45(V)	4.0(V)	20(A)	-20(A)	-65~175(°C)
(T _C =25°C)							

• Application

2SC2509 (V03-2509-06) HF power amplifier for S,V type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

Item	Pc	V _{CB0}	V _{CES}	V _{CEO}	V _{EB0}	IC	IE	Tstg
Value	20(W)	40(V)	40(V)	18(V)	4(V)	5(A)	-5(A)	-55~150(°C)
(T _C =25°C)								

• Application

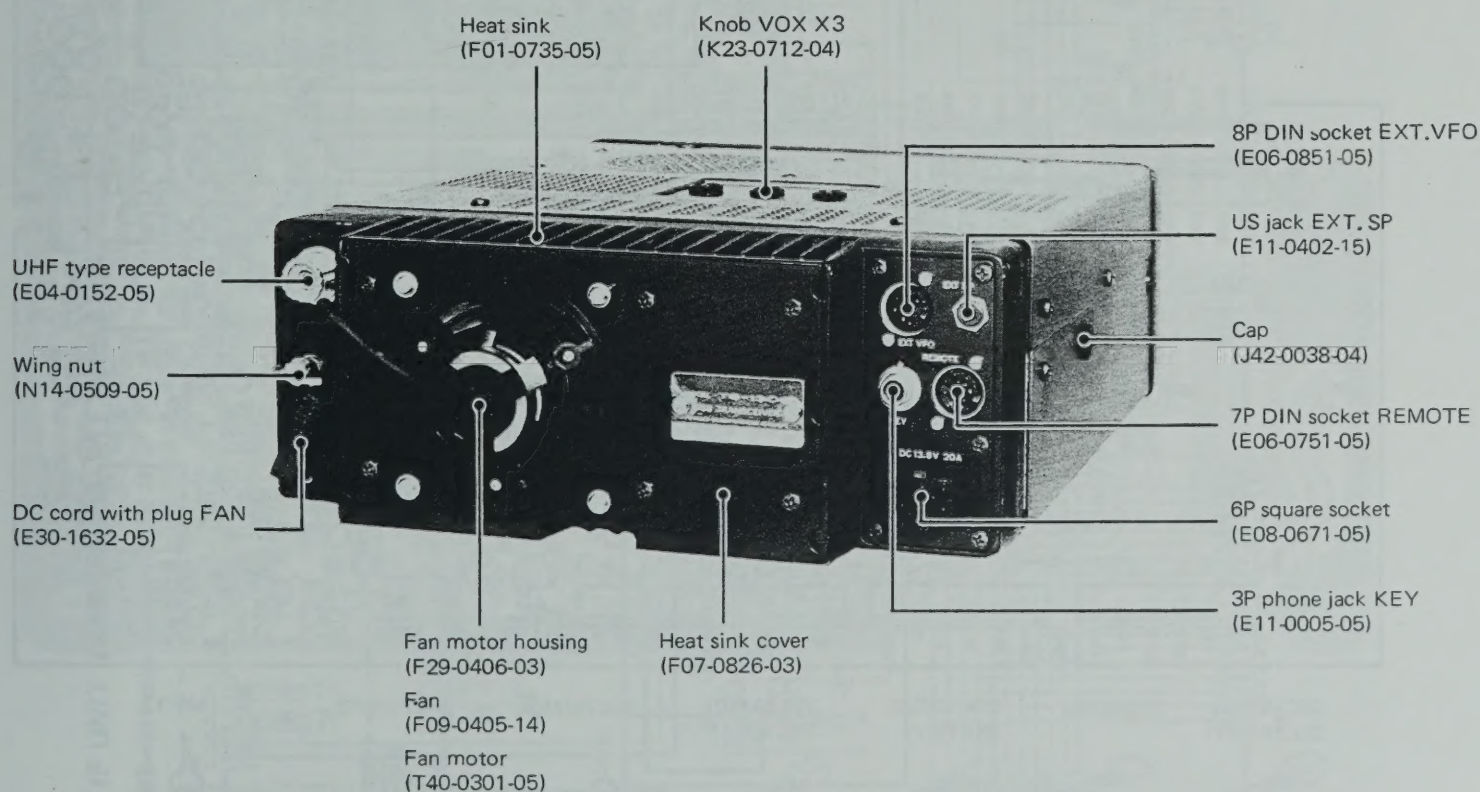
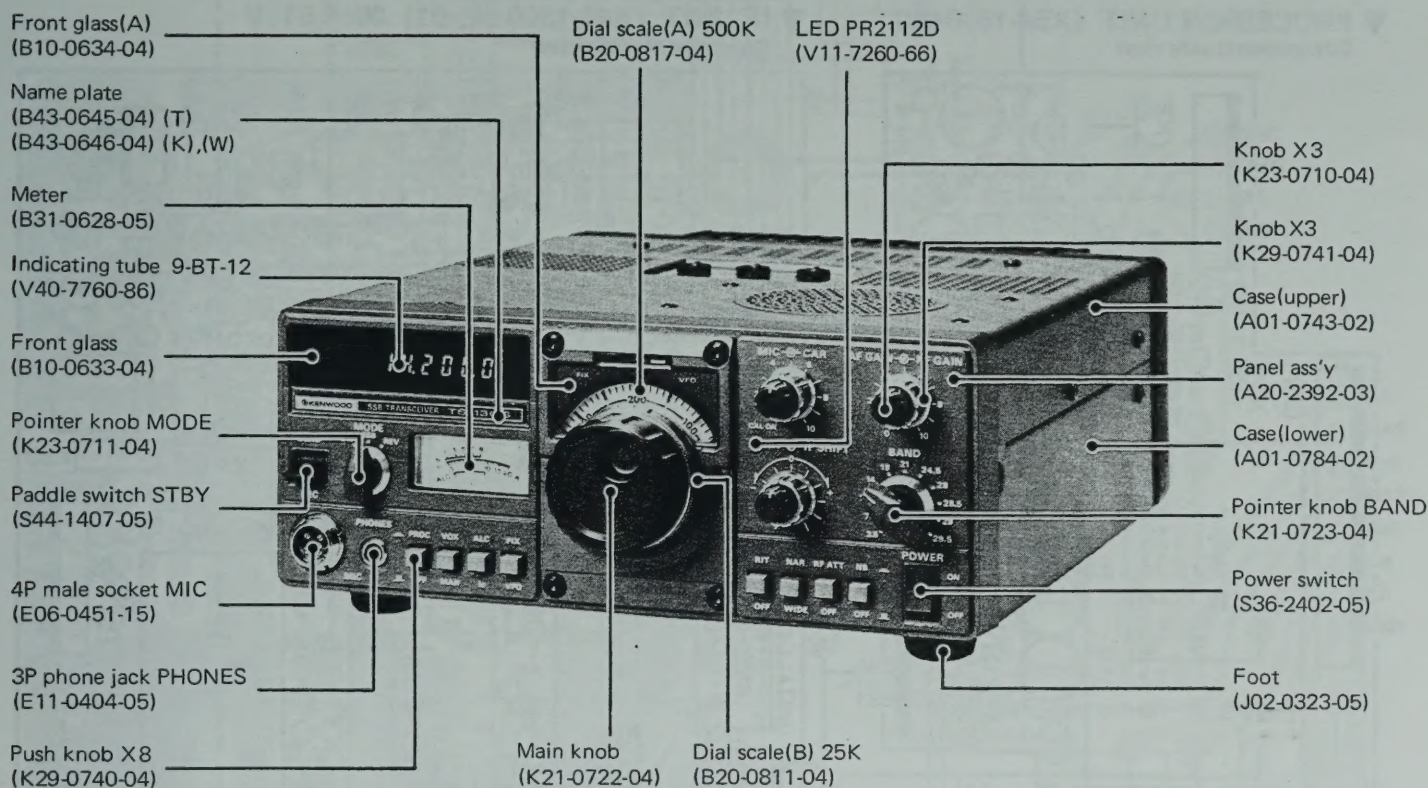
2SC2075 (V03-2075-06) HF power amplifier for V type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

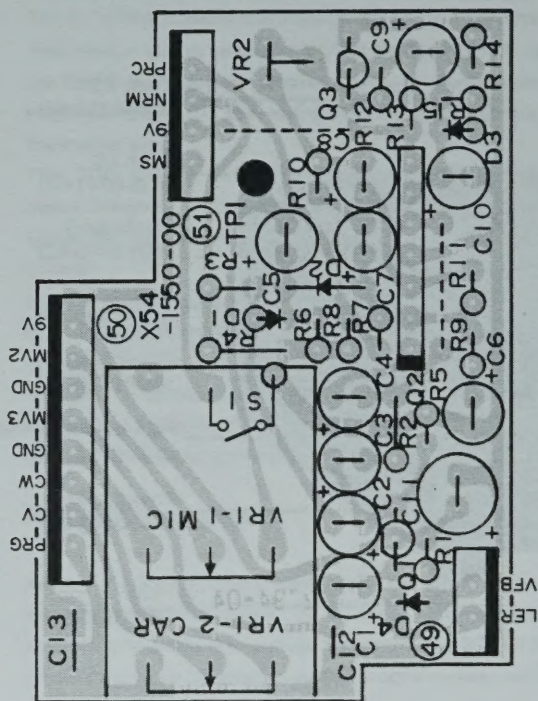
Item	Pc	V _{CB0}	V _{CES}	V _{CEO}	IC	IE	Tstg
Value	10(W)	80(V)	80(V)	4.0(V)	4(A)	-4(A)	-55~150(°C)
(T _C =25°C)							

OUTSIDE VIEWS (S TYPE)



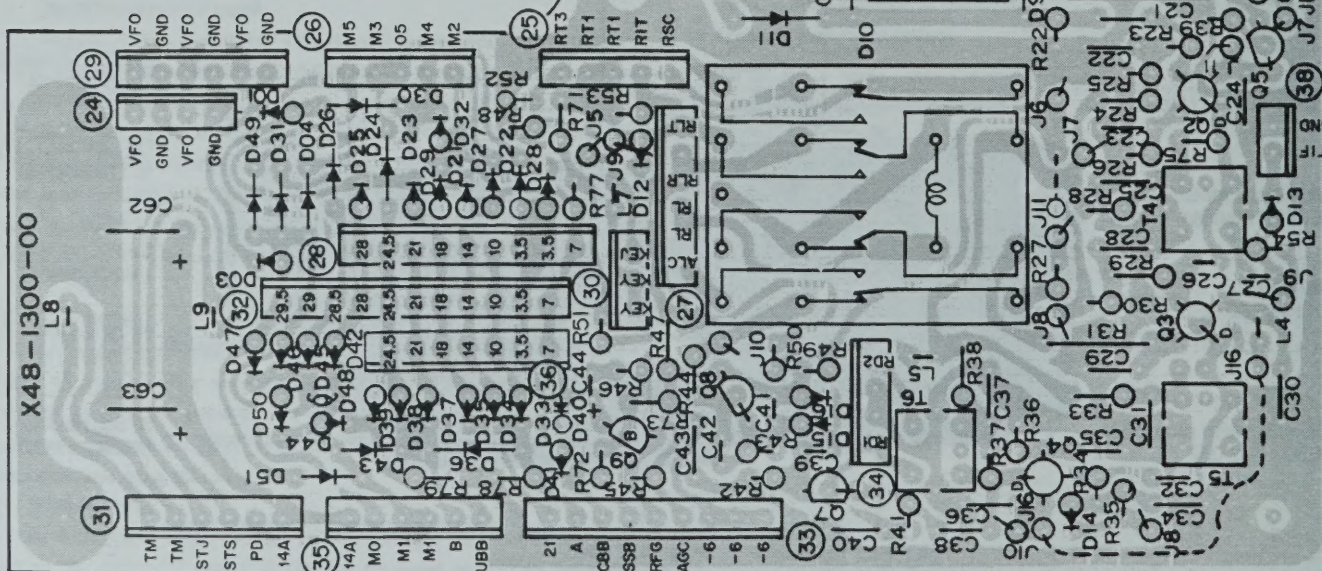
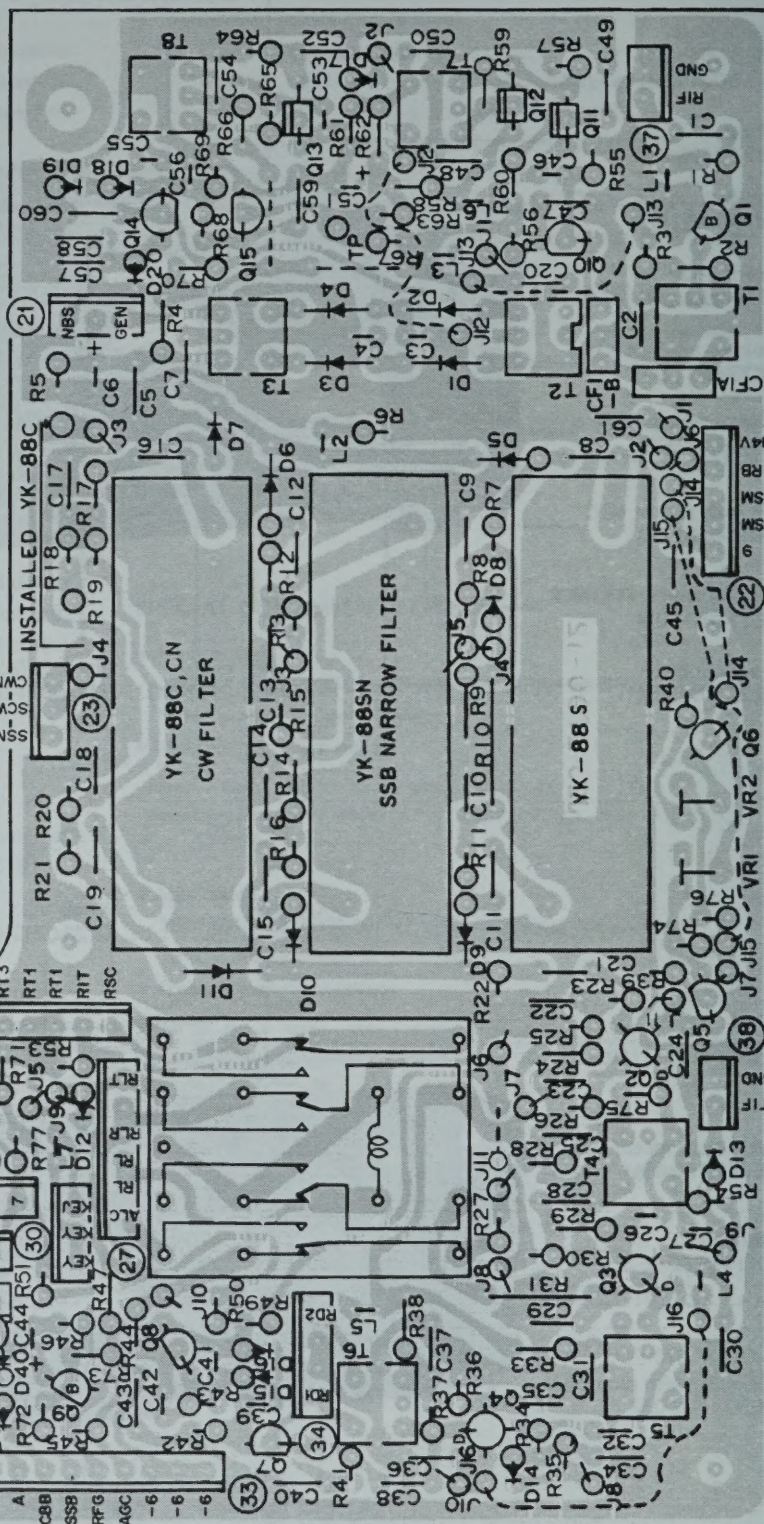
TS-130SV PC BOARD VIEWS

▼ PROCESSOR UNIT (X54-1550-00) Components side view



Q1,3: 2SC1815(Y) Q2: μ PC1158H2
D1,2: 2S1555 D3: 1N60 D4: PR2112D

▼ IF UNIT (X48-1300-00,-01) 00:S,01:V Components side view



2SC1675L
2SC1815(Y)

2SC460(B)

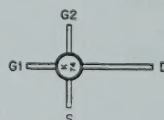
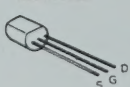
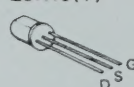
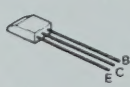
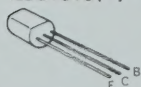
2SK19(GR)
2SK19(Y)

2SK30A(O)
2SK125

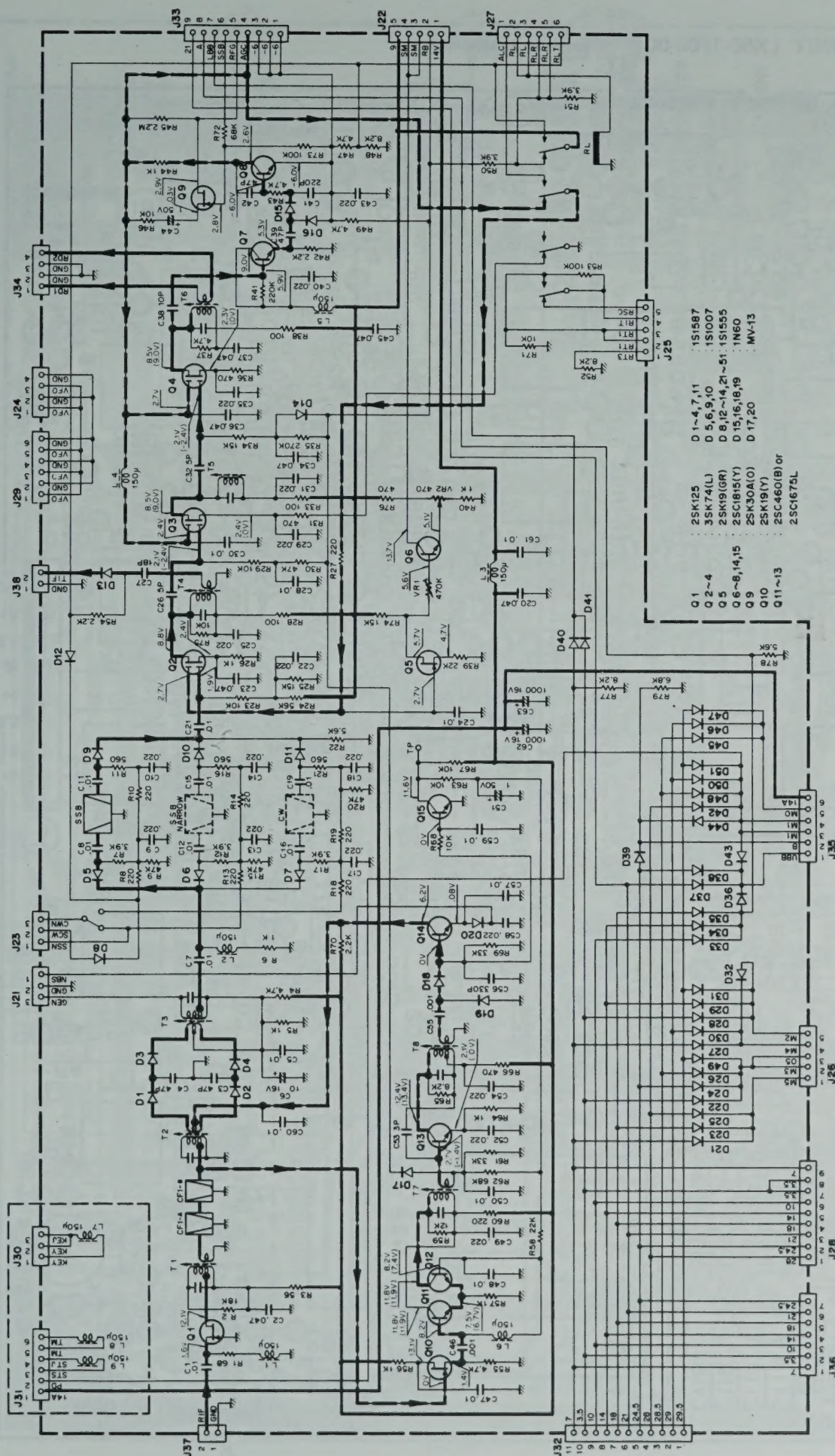
3SK74(L)

μ PC1158H2

MV-13

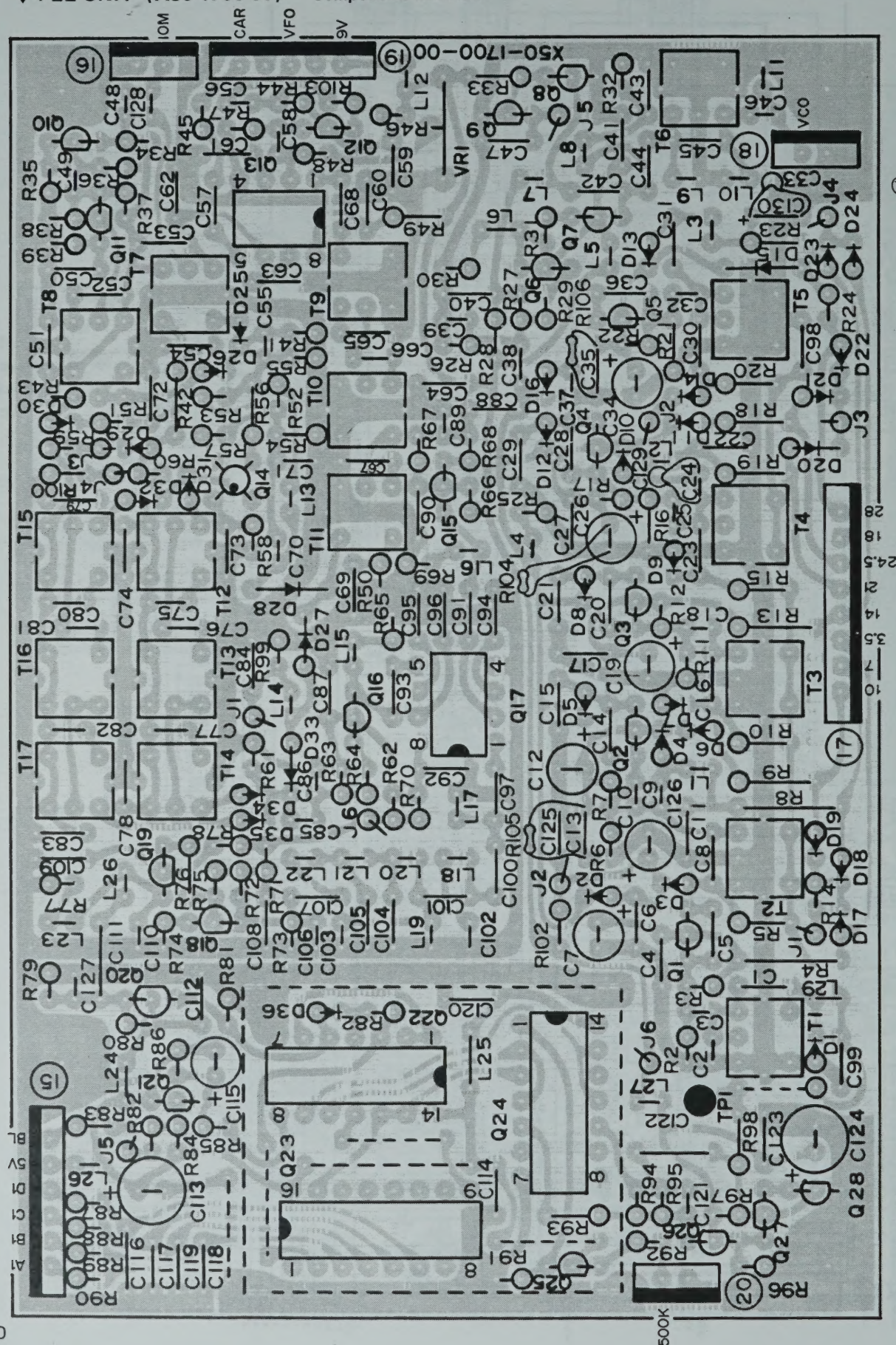


TS-130V does not use J30 and J31.



▼ PLL UNIT (X50-1700-00)

Components side view



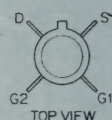
2SC1675L
2SC1775(E)
2SC1923(O)
2SC1959(Y)



2SC460(B)



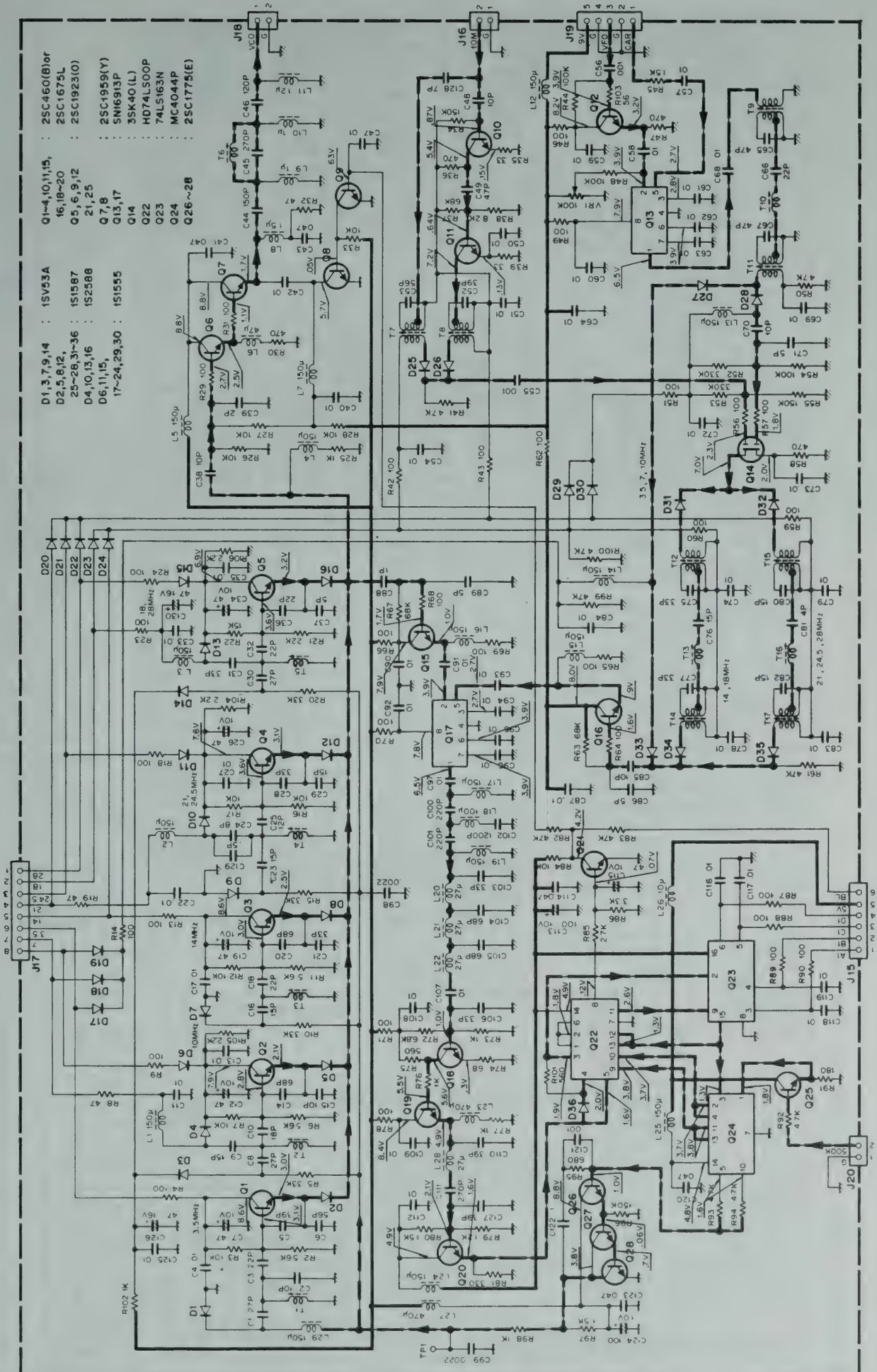
3SK40(L)



SN16913P

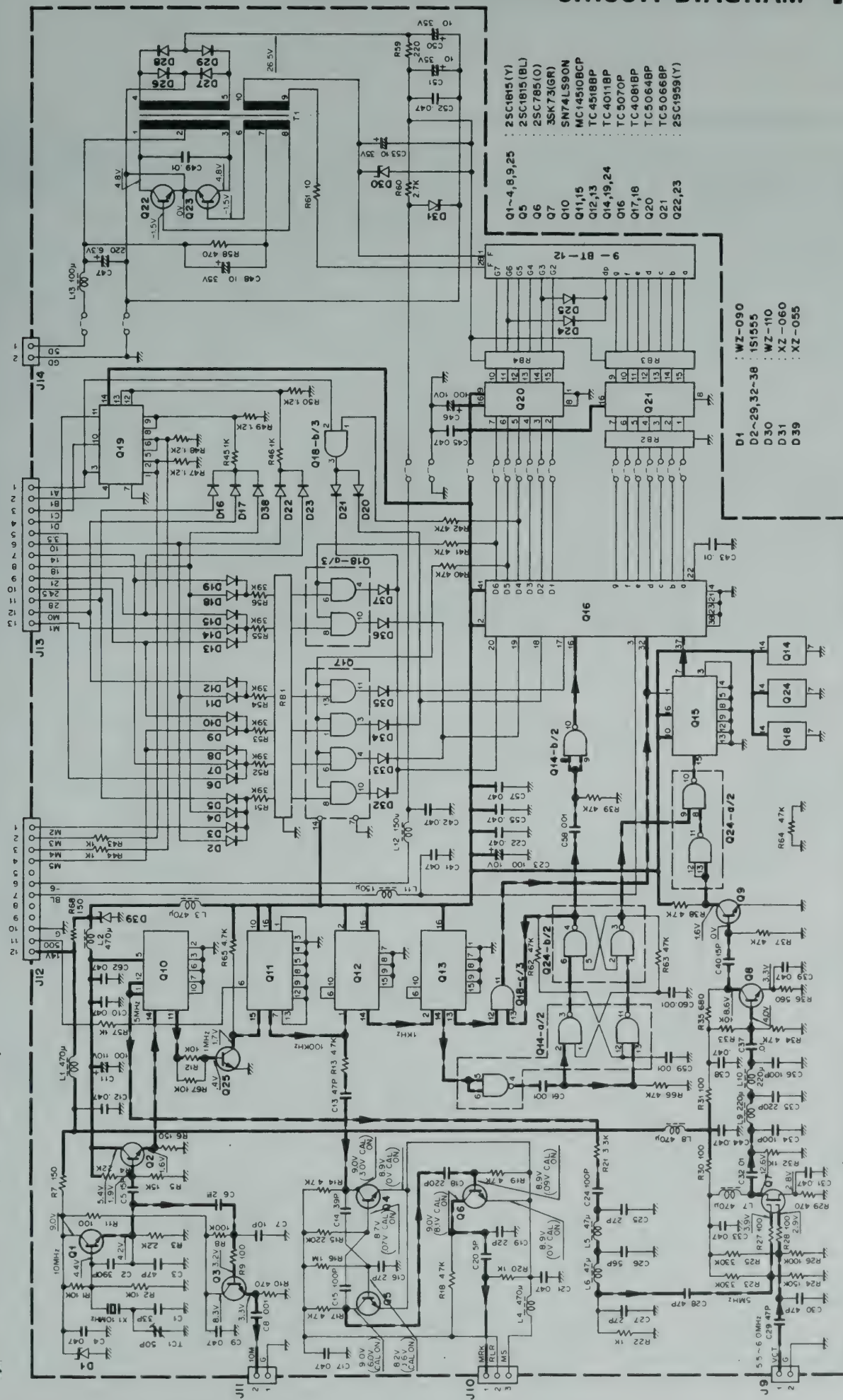


▶ PLL UNIT (X50-1700-00)

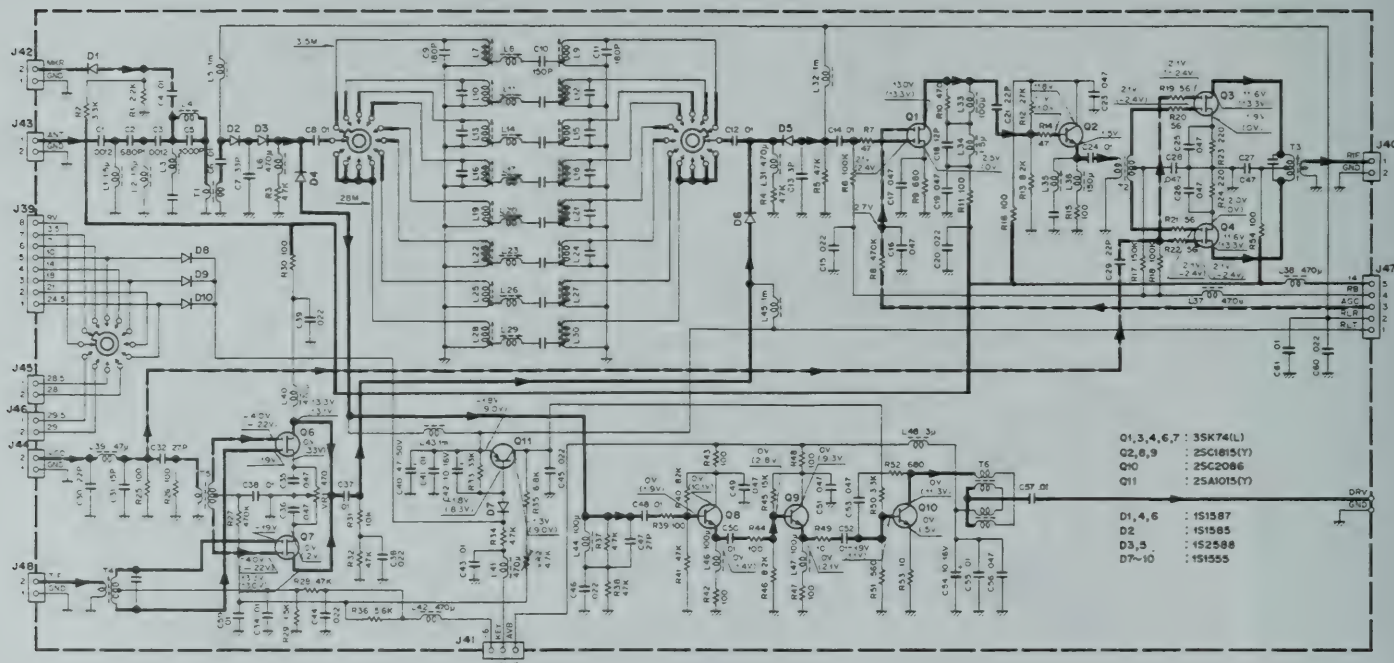
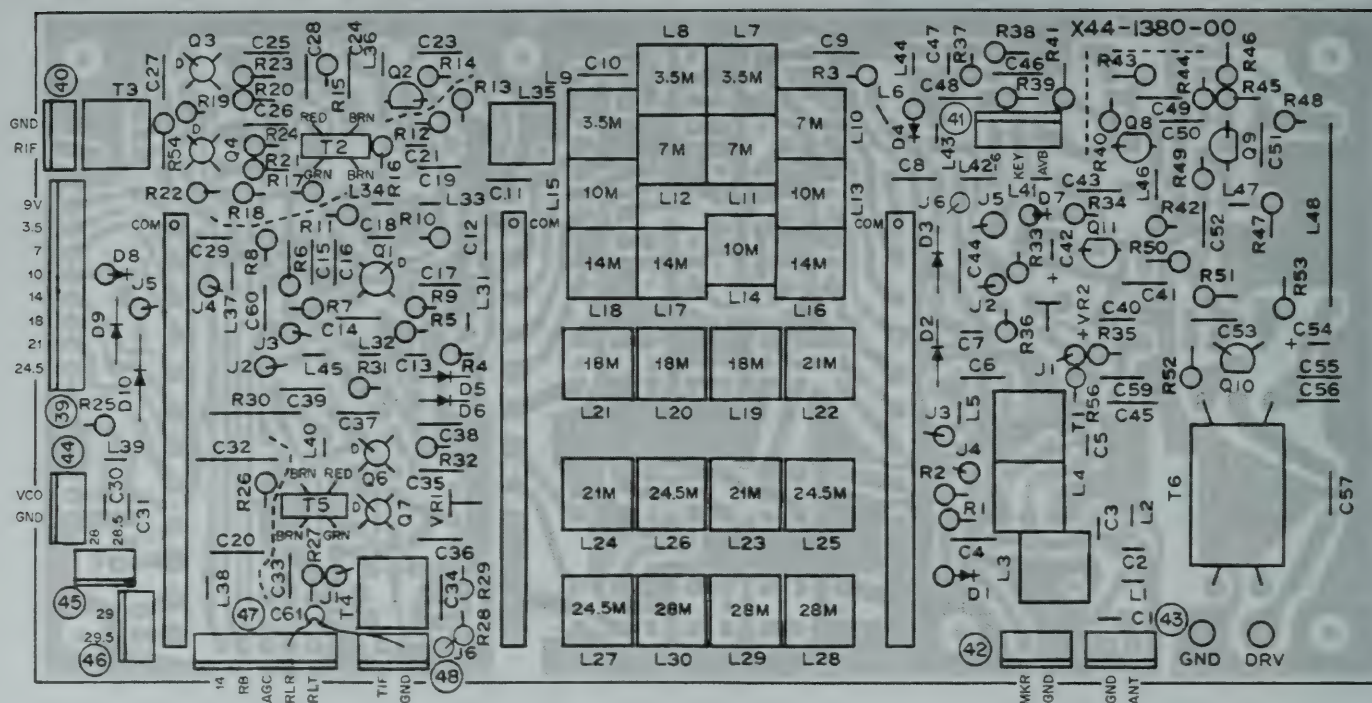




▼ COUNTER UNIT (X54-1560-00)



▼ RF UNIT (X44-1380-00) Components side view



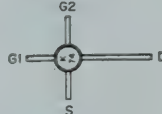
2SC1015(Y)
2SC1675L
2SC1815(Y)
2SC1959(Y)

2SC460(B)

2SC2086

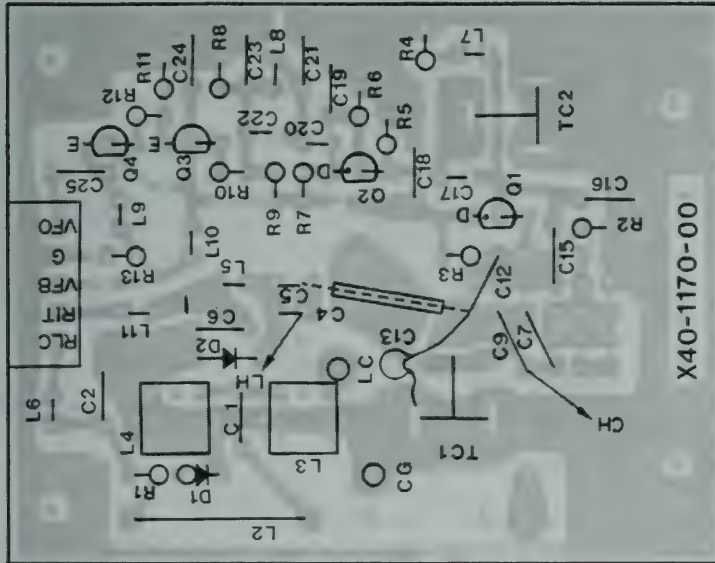
2SK19(Y)

3SK74(L)



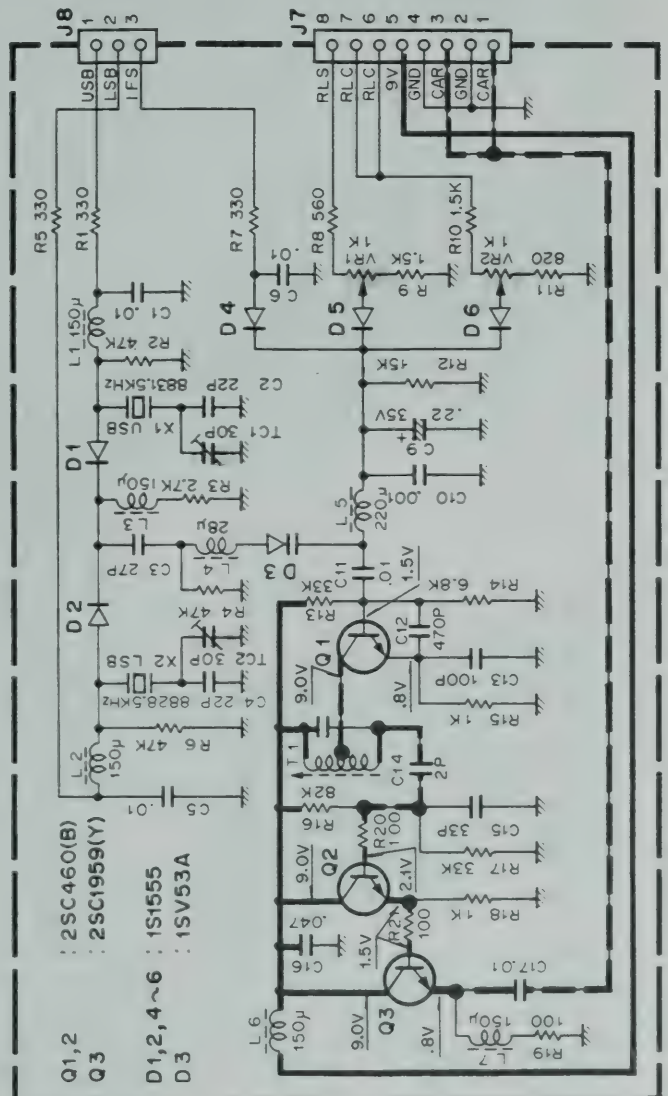
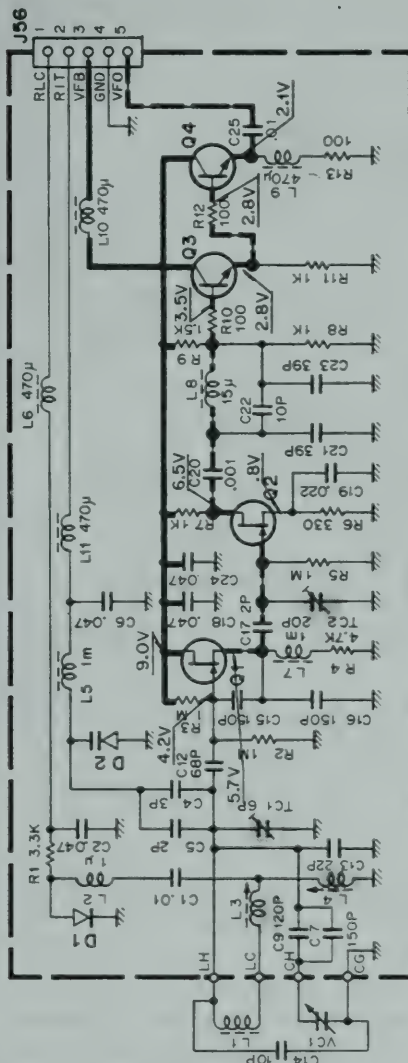
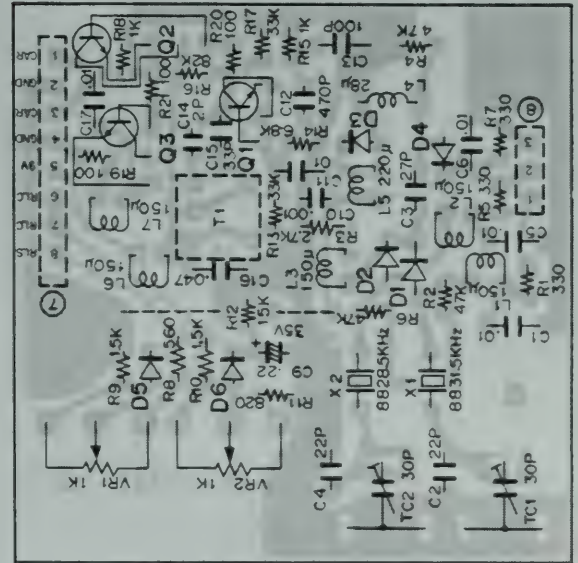
▼ VFO UNIT (X40-1170-00)

Components side view



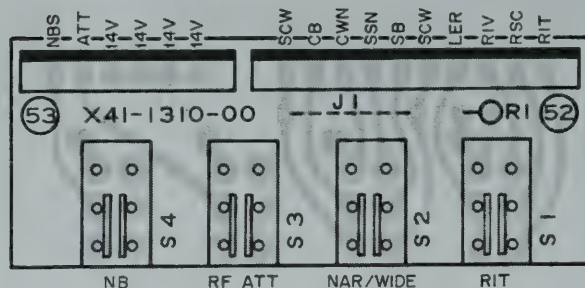
▼ CAR UNIT (X50-1500-00)

Foil side view



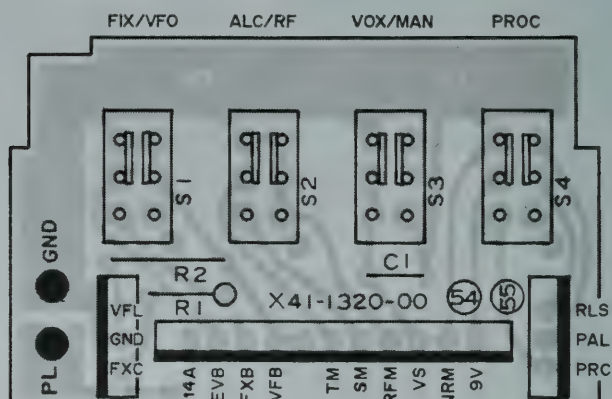
▼ SWITCH (A) UNIT (X41-1310-00)

Components side view

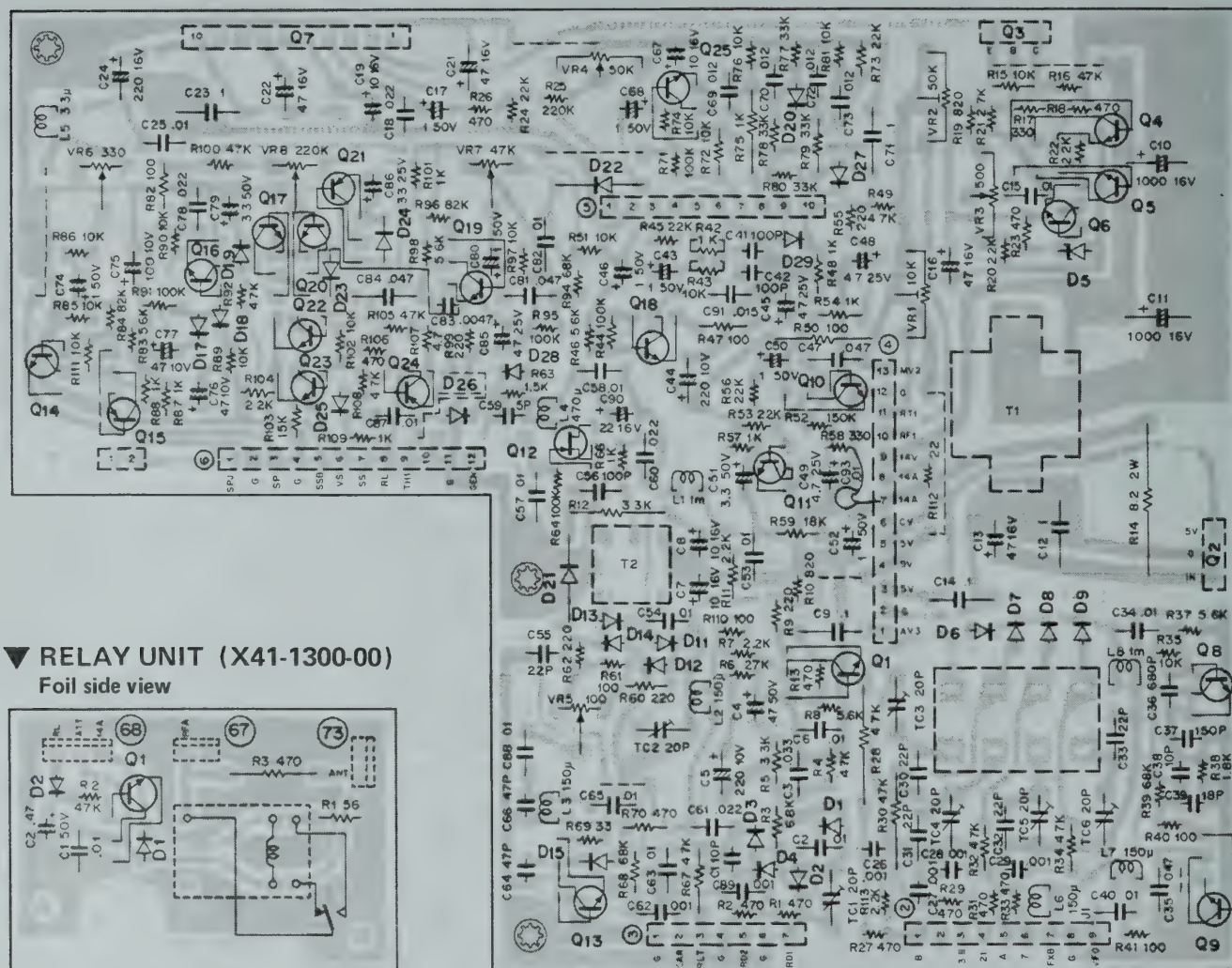


▼ SWITCH (B) UNIT (X41-1320-00)

Components side view

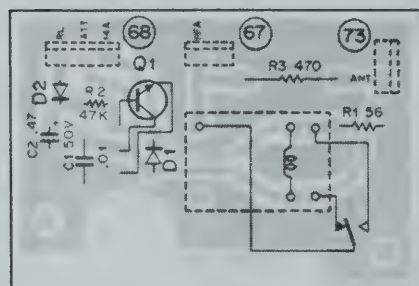


▼ AF-GEN UNIT (X49-1110-01) Foil side view



▼ RELAY UNIT (X41-1300-00)

Foil side view



Q1: 2SC1959(Y) D1,2: 1S1555

Q1,18: 2SC2240(GR) Q2: μ PC14305H Q3: 2SA473(Y)

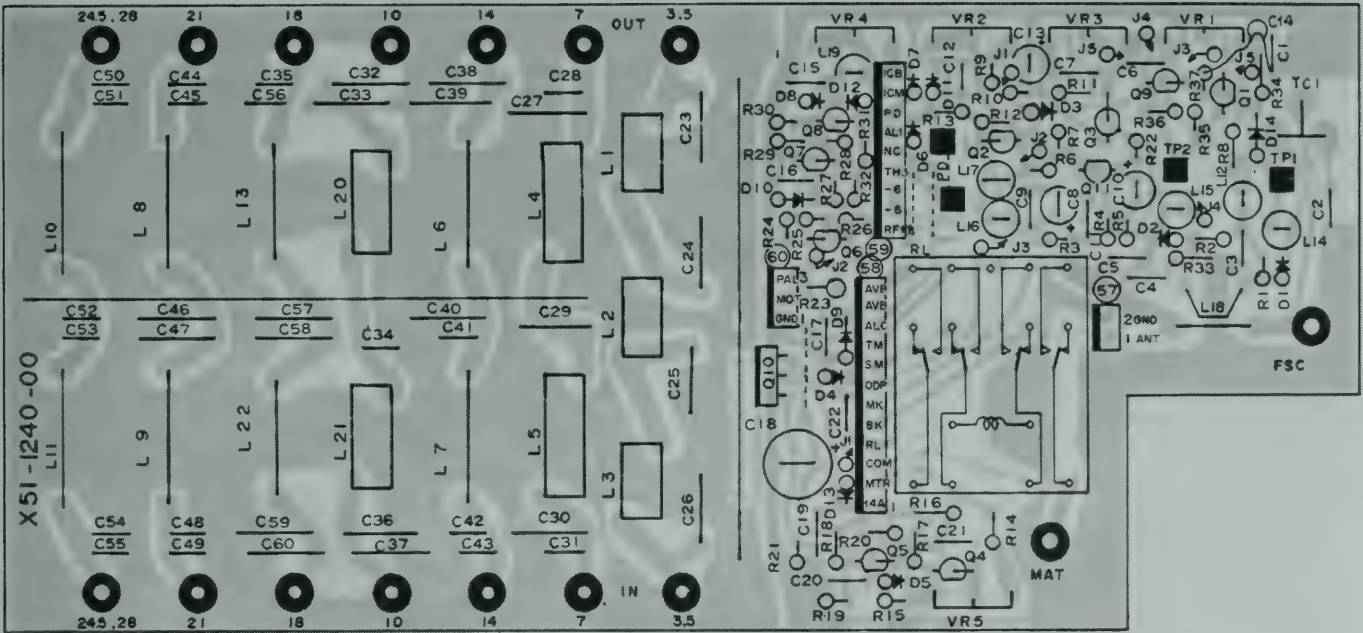
Q4~6,10,11,14,16,17,19,20,23,25: 2SC1815(Y) Q7: HA1366W or HA1366WR

Q8,13: 2SC460(B) or 2SC1675L Q9: 2SC1959(Y) Q12: 2SK19(GR) Q15,21: 2SA1015(Y)

Q22: 2SC1815(GR) Q24: 2SA562(Y) D1~4, 11~14,23,24,26: 1N60 D5: WZ-061

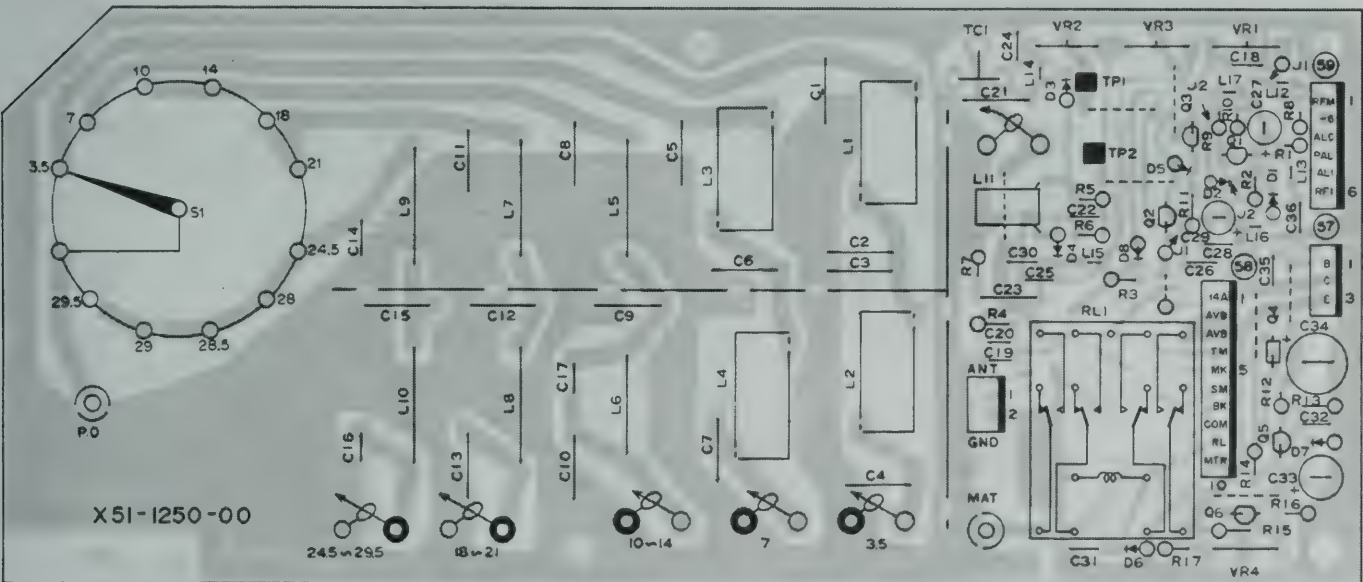
D6~9: 1S2588 D15: 1S1587 D17~22,25,27~29: 1S1555

▼ FILTER UNIT (X51-1240-00) S TYPE Components side view



Q1~5,7~9: 2SC1815(Y) Q6: 2SA562(Y) Q10: 2SA473(Y) Q11: 2SK30A(O) D1,2: 1N60 D3: WZ-044
D4,6,7,9,12,14: 1S1555 D5,10: WZ-061 D8,11,13: WZ-090

▼ FILTER UNIT (X51-1250-00) V TYPE **Components side view**



Q1: 2SK30A(O) Q2,3,5,6: 2SC1815(Y) Q4: 2SA496(Y) D1: WZ-090 D2,6: 1S1555 D3,4,8: 1N60 D5: WZ-044 D7: WZ-061

2SA1015(Y)
2SC1675L
2SC1815(GR)
2SC1815(Y)
2SC1959(Y)
2SC2240(GR)

2SC460(B)

2SA496(Y)

2SA473(Y)

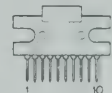
2SA562(Y)

2SK19(GF

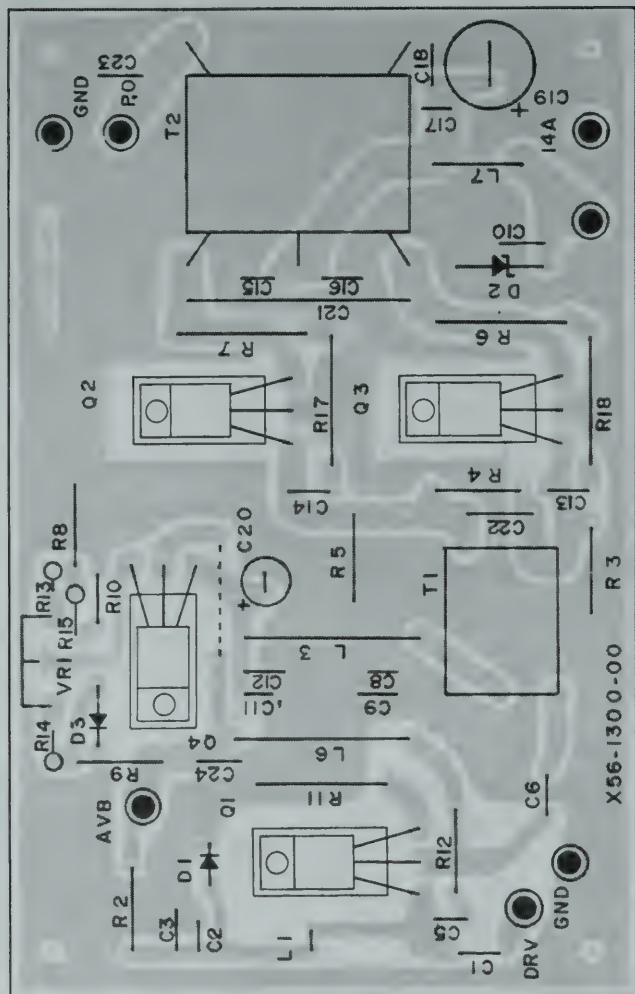
2SK30A(O)

μPC14305H

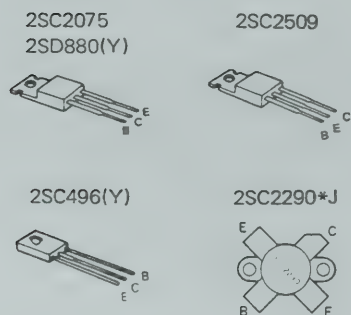
HA1366W
HA1366WR



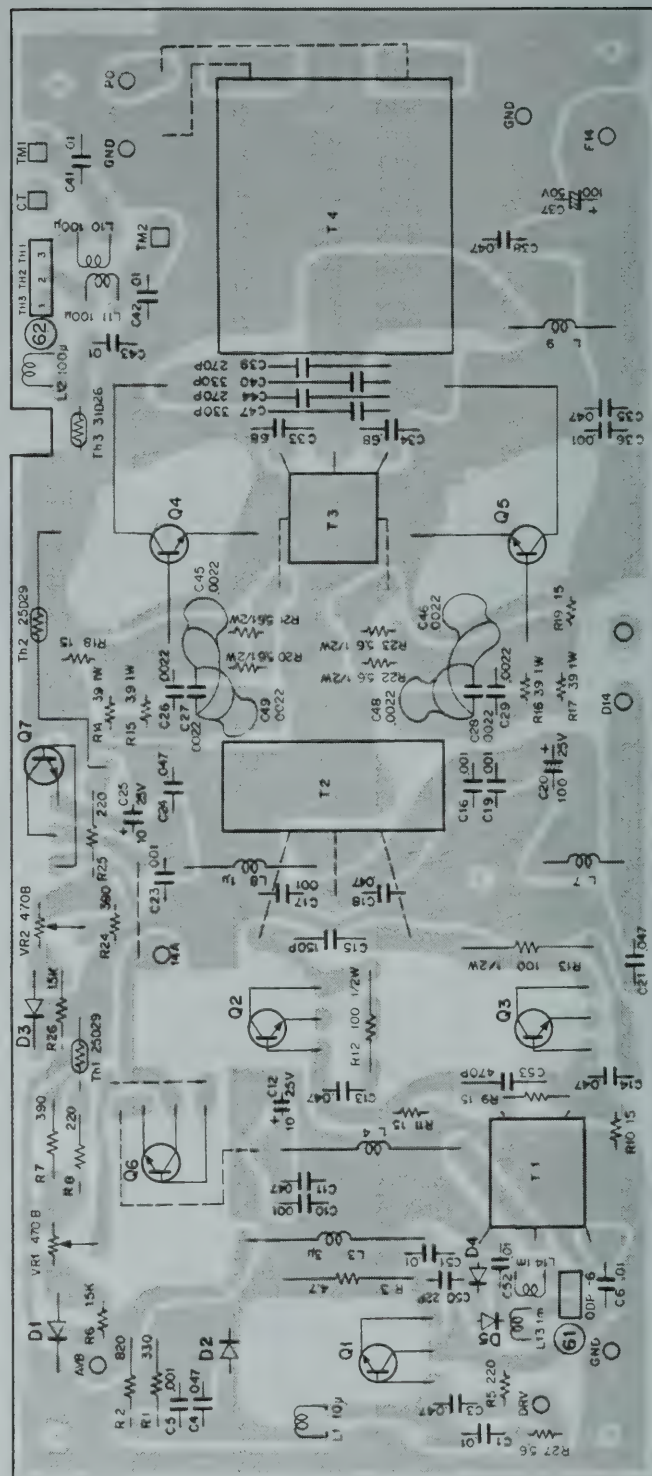
▼ FINAL UNIT (X56-1300-00) V TYPE Components side view



Q1: 2SC2075 Q2,3: 2SC2509 Q4: 2SC496(Y) Q5: 2SD880(Y)
D1: SV-4A D2: BZ-240 D3: SV-03



▼ FINAL UNIT (X56-1350-00) S TYPE Components side view



Q1: 2SC2075 Q2,3: 2SC2509 Q4,5: 2SC2290*J
Q6,7: 2SD880(Y) D1,3: SV-03 D2: SV-4A D4,5: 1N60

PARTS LIST

Note 1:

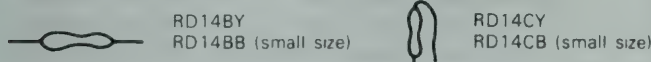
K USA T Britain W Europe X Australia

Note 2:

Only special type of resistors (example cement, metal film, etc) and capacitors (example electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the PC board illustration. Resistors not otherwise detailed are carbon type (1/4W or 1/8W). Order carbon resistors and capacitors according to the following example.

A carbon resistor's part number is RD14BY 2E222J

A ceramic capacitor's number is CK45F1H103Z, CC45TH1H220J

RESISTOR**1. Type of the carbon resistor****2. Wattage**

1W → 3A 3W → 3F 5W → 3H
2W → 3D 4W → 3G

3' = CC45 ○ ○ ...

Ceramic capacitor (type I) temperature coeff. capacitor 1' 3'

1st word (Color)	C (Black)	L (Red)	P (Orange)	R (Yellow)	S (Green)	T (Blue)	U (Violet)
ppm/°C	0	-80	-150	-220	-330	-470	-750

3 = CK45 ○

Ceramic capacitor (type II) 3

Cord	B	D	E	F
Operating temperature C	-30 +85	-30 +85	-30 +85	-10 +70

6 = Tolerance

Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10 μF -10 ~ +50 Less than 4.7 μF -10 ~ +75

Less than 10 pF

Cord	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

Abbreviation		Abbreviation	
Cap	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

3. Resistance value

② ② ② → means $22 \times 10^2 = 2200\Omega$ (2.2 kΩ)
Example 221 → 220Ω 223 → 22 kΩ 225 → 2.2 MΩ
222 → 2.2 kΩ 224 → 220 kΩ

4. Tolerance

J = ±5% (Gold) K = ±10% (Silver)

CAPACITORS**Type I**

CC 45 TH 1H 220 J
1' 2 3' 4 5 6
1 = Type ceramic, electrolytic, etc
2 = Shape round, square, etc
3 = Temp range
3' = Temp coefficient

Type II

CK 45 F 1H 103 Z
1 2 3 4 5 6
4 = Voltage rating
5 = Value
6 = Tolerance

Ex. CC45TH = -470 ±60 ppm/°C

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

5 = Capacitor value

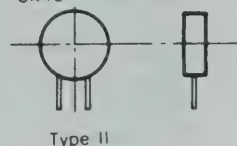
Example 010 → 1 pF
100 → 10 pF
101 → 100 pF
102 → 1000 pF = 0.001 μF
103 → 0.01 μF

CC45



Type I

CK45



Type II

TS-130 SEMICONDUCTOR

☆: New parts

Item	Name	Parts No.	Re- marks
Diode	1N60	V11-0051-05	☆
	1S1007	V11-4160-66	
	1S1555	V11-0076-05	
	1S1585	V11-3172-76	
	1S1587	V11-0370-05	
	1S2588	V11-0414-05	
	S31C	V11-2163-86	
	U05B	V11-0270-05	
Varistor	MV-13	V21-0004-05	☆
	SV-03	V21-0007-05	
	SV-4A	V11-4363-36	
Vari-cap diode	1SV53A	V11-4161-36	
Item	Name	Parts No.	Re- marks
Thermistor	25D29	V11-3360-16	☆
	31D26	V11-7762-16	
LED	PR2112D	V11-7260-66	
	TLY-205	V11-3163-16	
Zener diode	BZ-240	V11-4160-96	
	XZ-055	V11-4105-50	
	XZ-060	V11-4101-20	
	WZ-044	V11-4161-06	
	WZ-061	V11-0243-05	
	WZ-090	V11-0240-05	
	WZ-110	V11-4161-46	
Indicating tube	9-BT-12	V40-7760-86	

PARTS LIST

Item	Name	Parts No.	Re- marks	Ref.No.	Parts No.	Description	Re- marks
TR	2SA473 (Y)	V01-0473-06			B05-0701-04	SP grill cloth	
	2SA496(Y)	V01-0113-05			B10-0633-04	Front glass	☆
	2SA562(Y)	V01-0032-05			B30-0818-05	Pilot lamp 12V,40mA	☆
	2SA1015(Y)	V01-1015-06			B31-0628-05	Meter	S ☆
					B31-0629-05	Meter	V ☆
	2SC460 (B)	V03-0079-05			B39-0407-04	Spacer	
	2SC496(Y)	V03-0336-05			B42-1644-04	Seal (VOX)	
	2SC785(O)	V03-0473-05			B42-1693-04	Seal (Adj.)	☆
	2SC1675L	V03-1675-10			B43-0645-04	Name plate	S(T) ☆
	2SC1775(E)	V03-1775-06			B43-0646-04	Name plate	S(K),S(W) ☆
	2SC1815(BL)	V03-1815-26			B43-0647-04	Name plate	V(T) ☆
	2SC1815(GR)	V03-1815-16			B43-0648-04	Name plate	V(K),V(W) ☆
	2SC1815(Y)	V03-1815-06			B46-0058-00	Warranty card	(K) ☆
	2SC1923(O)	V03-1923-06			B50-2750-00	Operating manual	(K),(W) ☆
	2SC1959(Y)	V03-1959-06			B50-2751-00	Operating manual	(T) ☆
	2SC2075	V03-2075-06					
	2SC2086	V03-2086-06			D21-0807-05	Band shaft	
	2SC2240(GR)	V03-2240-06			D22-0404-05	Universal joint	
	2SC2290*J	V03-2290-16			D40-0615-04	Gear ass'y	☆
	2SC2509	V03-2509-06					
	2SD880(Y)	V04-0880-16			E04-0152-05	UHF type receptacle ANT	V
FET	2SK19(GR)	V09-0012-05			E06-0252-05	2P male socket POWER	V
	2SK19(Y)	V09-0011-05			E06-0451-15	4P male socket MIC	
	2SK30A(O)	V09-0056-05			E06-0751-05	7P DIN socket REMOTE	
	2SK125	V09-0136-10			E06-0851-05	8P DIN socket EXT.VFO	
	3SK40(L)	V09-0079-05			E07-0252-05	2P metal plug POWER	V
	3SK73(GR)	V09-1002-46			E07-0403-05	4P MIC plug (W),(T)	
	3SK74(L)	V09-1002-56			E07-0751-05	7P DIN plug REMOTE	
					E08-0671-05	6P square socket POWER	S
IC	74LS163N	V30-1037-06			E09-0671-05	6P plug POWER	S
	HA1366W	V30-1045-06			E11-0005-15	3P phone jack KEY	V
	HD74LS00P	V30-0192-16			E11-0402-15	US jack EXT. SP	
	MC14510BCP	V30-1227-16			E11-0404-05	3P phone jack PHONES	V
	MC4044P	V30-0173-05			E11-0404-05	3P phone jack KEY.PHONES	S
	SN74LS90N	V30-1005-26			E12-0001-05	phone plug EXT. SP	
	SN16913P	V30-1048-06			E23-0015-04	Lug terminal	S
	TC4011BP	V30-0301-70			E23-0417-05	Pin for 6P square socket POWER	S
	TC4029BP	V30-1051-06			E23-0418-05	Pin for 6P plug POWER	S
	TC4081BP	V30-0299-10			E23-0420-05	Lug terminal	S
	TC4518BP	V30-1039-06			E29-0407-05	Bridge connector	
	TC5064BP	V30-1056-06			E30-1632-05	DC cord with plug FAN	S
	TC5066BP	V30-1057-06			E30-1638-05	DC cord ass'y	S
	TC5070P	V30-1172-06	☆		E30-1675-05	DC cord ass'y	V ☆
	μPC1158H2	V11-1177-26	☆		E31-0431-05	Speaker cord with 2P plug	
	μPC14305H	V30-1029-36					
					F05-2034-05	Fuse (20A)	S
					F05-4022-05	Fuse (4A)	V
					F07-0826-03	Heat sink cover	S
					F09-0405-14	Fan	S
					F29-0406-03	Fan motor housing	S
					G01-0801-04	Gnd spring BAND	
					G02-0505-05	Knob spring	
					H01-2705-04	Carton case (inside)	S(K),S(W) ☆
					H01-2706-04	Carton case (inside)	S(T) ☆
					H01-2708-04	Carton case (inside)	V(K),V(W) ☆
					H01-2709-04	Carton case (inside)	V(T) ☆
					H03-1769-04	Carton case (outside)	S ☆
					H03-1770-04	Carton case (outside)	V ☆

Ref.No.	Parts No.	Description	Re- marks
TS-130 S,V GENERAL			
	A01-0725-02	Case (upper)	V
	A01-0743-02	Case (upper)	S
	A01-0784-02	Case (lower)	S ☆
	A01-0785-02	Case (lower)	V ☆
	A20-2392-03	Panel ass'y	S ☆
	A20-2393-03	Panel ass'y	V ☆

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
VR1 VR2 R7	H10-2509-02	Packing fixture (F)			X56-1300-00	Final unit	V
	H10-2510-02	Packing fixture (R)	V		X56-1350-00	Final unit	S
	H10-2520-02	Packing fixture (R)	S	RELAY UNIT (X41-1300-00)			
	H12-0441-04	Cushion	V	C2	CE04W1HR47	E 0.47 μ F	50V
	H12-0462-04	Cushion	S		E40-0273-05	Mini connect wafer	2P
	H20-1405-03	Protective cover	V		E40-0373-05	Mini connect wafer	3P
	H20-1410-03	Protective cover	S		S51-1404-05	Relay (G2E)	
	H21-0701-04	Protective sheet	VOX	SWITCH (A) UNIT (X41-1310-00)			
	H25-0112-04	Protective bag		S1~4	E40-0673-05	Mini connect wafer	6P
	H25-0116-04	Protective bag			E40-1073-05	Mini connect wafer	10P
	J02-0323-05	Foot			S40-2404-05	Push switch	
	J02-0407-04	Assistant foot					
	J13-0404-05	Fuse holder	S	SWITCH (B) UNIT (X41-1320-00)			
	J19-1301-04	Diode holder		S1~4	E23-0046-04	Square terminal	
	J21-2504-04	SP mounting hardware			E40-0373-05	Mini connect wafer	3P
	J21-2573-04	Foot mounting hardware			E40-1174-05	Mini connect wafer	11P
	J21-2631-04	Motor mounting hardware	S		S40-2405-05	Push switch	
	J31-0141-04	Spacer ring	MIC	RF UNIT (X44-1380-00)			
	J42-0038-04	Cap	Case (lower)	C5	CQ09S1H102J	S 0.001 μ F	
	J42-0423-04	Knob bush			CC45RH1H330J	C 33pF	
	J61-0019-05	Vinyle tie			CC45RH1H181J	C 180pF	
	J61-0401-05	Nylon band			CC45RH1H151J	C 150pF	
	K21-0723-04	Pointer knob	BAND	C11	CC45RH1H181J	C 180pF	
	K23-0710-04	Knob			CC45RH1H030C	C 3pF ± 0.25 pF	
	K23-0711-04	Pointer knob	MODE		C91-0456-05	C 0.047 μ F	25V
	K23-0712-04	Knob	VOX		CC45RH1H120J	C 12pF	
	K29-0740-04	Push knob		C19	C91-0456-05	C 0.047 μ F	25V
	K29-0741-04	Knob			CC45SL1H220J	C 22pF	
	L40-1511-03	Ferri-inductor	150 μ H		C91-0456-05	C 0.047 μ F	25V
	L40-4711-03	Ferri-inductor	470 μ H		C91-0456-05	C 0.047 μ F	25V
	N14-0508-04	Spanner nut M9	BAND	C21	CC45SL1H220J	C 22pF	
	N14-0518-04	Spanner nut M7	MODE		C91-0456-05	C 0.047 μ F	25V
	N19-0607-04	Nylon washer			C91-0456-05	C 0.047 μ F	25V
	R19-3409-05	Pot. 10k Ω (A)/10k Ω (B)	RF/AF		C91-0456-05	C 0.047 μ F	25V
	R19-9405-05	Pot. 10k Ω (F)/5k Ω (B)	RIT/IF	C23	C91-0456-05	C 0.047 μ F	25V
	R92-0620-05	Cement resistor 15m Ω			C91-0456-05	C 0.047 μ F	25V
	S01-2422-05	Rotary switch	MODE		C91-0456-05	C 0.047 μ F	25V
	S01-2423-05	Rotary switch	BAND		C91-0456-05	C 0.047 μ F	25V
	S36-2402-05	Power switch		C25~28	C91-0456-05	C 0.047 μ F	25V
	S44-1407-05	Paddle switch	STBY		C91-0456-05	C 0.047 μ F	25V
	T03-0027-15	Speaker			C91-0456-05	C 0.047 μ F	25V
	T40-0301-05	Fan motor	S		C91-0456-05	C 0.047 μ F	25V
	X40-1170-00	VFO unit		C31	C91-0456-05	C 0.047 μ F	25V
	X41-1300-00	Relay unit			C91-0456-05	C 0.047 μ F	25V
	X41-1310-00	Switch (A) unit	power side		C91-0456-05	C 0.047 μ F	25V
	X41-1320-00	Switch (B) unit	MIC side		C91-0456-05	C 0.047 μ F	25V
	X44-1380-00	RF unit		C33,34	C91-0456-05	C 0.047 μ F	25V
	X48-1300-00	IF unit	S		C91-0456-05	C 0.047 μ F	25V
	X48-1300-01	IF unit	V		C91-0456-05	C 0.047 μ F	25V
	X49-1110-01	AF-GEN unit			C91-0456-05	C 0.047 μ F	25V
	X50-1500-00	CAR unit		C35,36	C91-0456-05	C 0.047 μ F	25V
	X50-1700-00	PLL unit			C91-0456-05	C 0.047 μ F	25V
	X51-1240-00	Filter unit	S		C91-0456-05	C 0.047 μ F	25V
	X51-1250-00	Filter unit	V		C91-0456-05	C 0.047 μ F	25V
	X54-1450-01	Indicator unit	VFO	C40	C91-0456-05	C 0.047 μ F	25V
	X54-1550-00	Processor unit			C91-0456-05	C 0.047 μ F	25V
	X54-1560-00	Counter unit			C91-0456-05	C 0.047 μ F	25V
					C91-0456-05	C 0.047 μ F	25V
				C42	E23-0401-05	Round terminal	
					E40-0273-05	Mini connect wafer	2P
					E40-0373-05	Mini connect wafer	3P
					E40-0573-05	Mini connect wafer	5P
				C47	E40-0873-05	Mini connect wafer	8P

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
	J31-0502-04	PC Board collar		IF UNIT (X48-1380-00,-01) 00:S, 01:V			
	J42-0404-05	PC Board bush		C3,4	CC45SL1H470J	C 47pF	
L1,2	L40-1592-02	Ferri-inductor 1.5μH		C6	CE04W1C100	E 10μF 16V	
L3	L34-0966-05	Trap coil 8.83M	☆	C23	C91-0456-05	C 0.047μF 25V	
L4	L34-0558-05	Trap coil		C26	CC45SL1H050C	C 5pF ±0.25pF	
L5	L40-1021-03	Ferri-inductor 1mH		C27	CC45SL1H180J	C 18pF	
L6	L40-4711-03	Ferri-inductor 470μH		C32	CC45SL1H050C	C 5pF ±0.25pF	
L7	L34-0967-05	BPF coil 3.5A	☆	C34,36	C91-0456-05	C 0.047μF 25V	
L8	L34-0968-05	BPF coil 3.5B	☆	C38	CC45SL1H100D	C 10pF ±0.5pF	
L9	L34-0967-05	BPF coil 3.5A	☆	C39,42	CC45SL1H470J	C 47pF	
L10	L34-0969-05	BPF coil 7A	☆	C44,51	CE04W1H010	E 1μF 50V	
L11	L34-0970-05	BPF coil 7B	☆	C53	CC45SL1H030C	C 3pF ±0.25pF	
L12	L34-0971-05	BPF coil 7C	☆	C62,63	C90-0817-05	E 1000μF 16V	
L13	L34-0972-05	BPF coil 10A	☆		E23-0046-04	Square terminal	
L14	L34-0973-05	BPF coil 10B	☆		E23-0401-05	Round terminal	
L15	L34-0974-05	BPF coil 10C	☆		E40-0273-05	Mini connect wafer 2P	
L16	L34-0975-05	BPF coil 14A	☆		E40-0373-05	Mini connect wafer 3P	
L17	L34-0976-05	BPF coil 14B	☆		E40-0473-05	Mini connect wafer 4P	
L18	L34-0977-05	BPF coil 14C	☆		E40-0573-05	Mini connect wafer 5P	
L19	L34-0978-05	BPF coil 18A	☆		E40-0673-05	Mini connect wafer 6P	
L20	L34-0979-05	BPF coil 18B	☆		E40-0773-05	Mini connect wafer 7P	
L21	L34-0980-05	BPF coil 18C	☆		E40-0973-05	Mini connect wafer 9P	
L22	L34-0981-05	BPF coil 21A	☆		E40-1173-05	Mini connect wafer 11P	
L23	L34-0982-05	BPF coil 21B	☆		J31-0502-04	PC Board collar	
L24	L34-0983-05	BPF coil 21C	☆		J42-0404-05	PC Board bush	
L25	L34-0984-05	BPF coil 24.5A	☆	L1~9	L40-1511-03	Ferri-inductor 150μH	S
L26	L34-0985-05	BPF coil 24.5B	☆	L1~6	L40-1511-03	Ferri-inductor 150μH	V
L27	L34-0986-05	BPF coil 24.5C	☆				
L28	L34-0707-05	BPF coil 28A		T1	L34-0957-05	Tuning coil	☆
L29	L34-0987-05	BPF coil 28B	☆	T2	L34-0942-05	Tuning coil	
L30	L34-0738-05	BPF coil 28C		T3	L34-0538-05	Tuning coil	
L31	L40-4711-03	Ferri-inductor 470μH		T4,5	L34-0535-05	Tuning coil	
L32	L40-1021-03	Ferri-inductor 1mH		T6	L34-0536-05	Tuning coil	
L33	L40-1011-03	Ferri-inductor 100μH		T7	L34-0535-05	Tuning coil	
L34	L40-1592-02	Ferri-inductor 1.5μH		T8	L34-0536-05	Tuning coil	
L35	L34-0966-05	Trap coil 8.83M	☆	CF1	L72-0310-05	Ceramic filter 8.83MHz	
L36	L40-1511-03	Ferri-inductor 150μH		XF1	L71-0208-05	MCF 8.83MHz	
L37,38	L40-4711-03	Ferri-inductor 470μH		VR1	R12-6405-05	Trim. pot 470kΩ	☆
L39	L40-4782-02	Ferri-inductor 0.47μH		VR2	R12-0416-05	Trim. pot 470Ω	
L40~42	L40-4711-03	Ferri-inductor 470μH			R92-0150-05	Short jumper	
L43	L40-1021-03	Ferri-inductor 1mH			S51-4401-05	Relay (LZN-4)	
L44	L40-1011-03	Ferri-inductor 100μH		AF-GEN UNIT (X49-1110-01)			
L45	L40-1021-03	Ferri-inductor 1mH		C1	CC45CH1H100D	C 10pF ±0.5pF	
L46,47	L40-1011-03	Ferri-inductor 100μH		C3	CQ92M1H333K	ML 0.033μF	
L48	L33-0032-05	Choke coil 3μH		C4	CE04W1HR47	E 0.47μF 50V	
T1	L34-0696-35	Input coil	☆	C5	CE04W1A221	E 220μF 10V	
T2	L19-0303-05	Wide bandwidth trans		C7,8	CE04W1C100	E 10μF 16V	
T3	L30-0506-05	IFT		C9	CQ92M1H104K	ML 0.1μF	
T4	L34-0697-05	Output coil		C10,11	C90-0817-05	E 1000μF 16V	☆
T5	L19-0303-05	Wide bandwidth trans		C12	CQ92M1H104K	ML 0.1μF	
T6	L19-0302-05	Wide bandwidth trans		C13	CE04W1C470	E 47μF 16V	
VR1	R12-0416-05	Trim. pot 470Ω					
VR2	R12-1408-05	Trim. pot 4.7kΩ	☆				
	R92-0150-05	Short jumper					
	S29-3406-05	Rotary wafer ass'y	☆				

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks
C14	CQ92M1H104K	ML 0.1 μ F	
C16	CE04W1C470	E 47 μ F 16V	
C17	CE04W1H010	E 1 μ F 50V	
C18	CQ92M1H223K	ML 0.022 μ F	
C19	CE04W1C100	E 10 μ F 16V	
C21,22	CE04W1C470	E 47 μ F 16V	
C23	CQ92M1H104K	ML 0.1 μ F	
C24	CE04W1C221	E 220 μ F 16V	
C30~33	CC45CH1H220J	C 22pF	
C37	CC45SL1H151J	C 150pF	
C38	CC45CH1H100D	C 10pF \pm 0.5pF	
C39	CC45SL1H180J	C 18pF	
C41,42	CC45SL1H101J	C 100pF	
C43	CE04W1H010	E 1 μ F 50V	
C44	CE04W1A221	E 220 μ F 10V	
C45	CE04W1E4R7	E 4.7 μ F 25V	
C46	CE04W1H010	E 1 μ F 50V	
C47	CQ92M1H473K	ML 0.047 μ F	
C48,49	CE04W1E4R7	E 4.7 μ F 25V	
C50	CE04W1H010	E 1 μ F 50V	
C51	CE04W1H3R3	E 3.3 μ F 50V	
C52	CE04W1H010	E 1 μ F 50V	
C55	CC45UJ1H220J	C 22pF	
C56	CC45SL1H101J	C 100pF	
C59	CC45CH1H050C	C 5pF \pm 0.25pF	
C64,66	CC45SL1H470J	C 47pF	
C67	CE04W1C100	E 10 μ F 16V	
C68	CE04W1H010	E 1 μ F 50V	
C69,70	CQ92M1H123K	ML 0.012 μ F	
C71	CQ92M1H104K	ML 0.1 μ F	
C72,73	CQ92M1H123K	ML 0.012 μ F	
C74	CE04W1H010	E 1 μ F 50V	
C75	CE04W1A101	E 100 μ F 10V	
C76,77	CE04W1A470	E 47 μ F 10V	
C78	CQ92M1H223K	ML 0.022 μ F	
C79	CE04W1H3R3	E 3.3 μ F 50V	
C80	CE04W1H010	E 1 μ F 50V	
C81	CQ92M1H473K	ML 0.047 μ F	
C83	CQ92M1H472K	ML 0.0047 μ F	
C84	CQ92M1H473K	ML 0.047 μ F	
C85	CE04W1E4R7	E 4.7 μ F 25V	
C86	CE04W1E3R3	E 3.3 μ F 25V	
C90	CE04W1C220	E 22 μ F 16V	
C91	CQ92M1H153K	ML 0.015 μ F	
C92	CC45SL1H050C	C 5pF \pm 0.25pF	
TC1~6	C05-0030-15	Ceramic trimmer 20pF	
	E18-0401-05	Crystal socket 4P	
	E40-0273-05	Mini connect wafer 2P	
	E40-0773-05	Mini connect wafer 7P	
	E40-0911-05	Mini connect wafer 9P	☆
	E40-1073-05	Mini connect wafer 10P	
	E40-1273-05	Mini connect wafer 12P	
	E40-1373-05	Mini connect wafer 13P	☆
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
L1	L40-1021-03	Ferri-inductor 1mH	
L2,3	L40-1511-03	Ferri-inductor 150 μ H	
L4	L40-4711-03	Ferri-inductor 470 μ H	
L5	L40-3392-02	Ferri-inductor 3.3 μ H	
L6,7	L40-1511-03	Ferri-inductor 150 μ H	
L8	L40-1021-03	Ferri-inductor 1mH	
Ref.No.	Parts No.	Description	Re- marks
T1	L15-0016-05	Choke	
T2	L34-0567-05	Tuning coil	
R14	RS14GB3D8R2J	Metal film 8.2 Ω 2W	
VR1	R12-3025-05	Trim.pot 10k Ω (B) RIT	
VR2	R12-4016-05	Trim.pot 50k Ω (B) RF	
VR3	R12-0042-05	Trim.pot 500 Ω (B) 9V	
VR4	R12-4016-05	Trim.pot 50k Ω (B) SIDE TONE	
VR5	R12-0401-05	Trim.pot 100 Ω (B) BM	
VR6	R12-0405-05	Trim.pot 330 Ω (B) ANTI.V	☆
VR7	R12-3408-05	Trim.pot 47k Ω (B) V.GAIN	☆
VR8	R12-5402-05	Trim.pot 220k Ω (B) DELAY	☆
	R92-0150-05	Short jumper	
CAR UNIT (X50-1500-00)			
C2	CC45UJ1H220J	C 22pF	
C3	CC45UJ1H270J	C 27pF	
C4	CC45UJ1H220J	C 22pF	
C9	CS15E1VR22M	T 0.22 μ F 35V	
C13	CC45SL1H101J	C 100pF	
C14	CC45CH1H020C	C 2pF \pm 0.25pF	
C15	CC45CH1H330J	C 33pF	
C16	C91-0456-05	C 0.047 μ F 25V	
TC1,2	C05-0056-05	Ceramic trimmer 30pF	
	E40-0373-05	Mini connect wafer 3P	
	E40-0873-05	Mini connect wafer 8P	
	J31-0502-04	PC Board collar	
	J42-0404-05	PC Board bush	
L1~3	L40-1511-03	Ferri-inductor 150 μ H	
L4	L33-0266-05	Choke coil 28 μ H	
L5	L40-2211-03	Ferri-inductor 220 μ H	
L6,7	L40-1511-03	Ferri-inductor 150 μ H	
T1	L32-0201-05	OSC coil	
X1	L77-0485-05	Crystal 8831.5kHz	
X2	L77-0486-05	Crystal 8828.5kHz	
VR1,2	R12-1012-05	Trim. pot 1k Ω (B)	
	R92-0150-05	Short jumper	
PLL UNIT (X50-1700-00)			
C1	CC45TH1H270J	C 27pF	
C2	CC45TH1H100D	C 10pF \pm 0.5pF	
C3	CC45TH1H220J	C 22pF	
C5	CC45RH1H390J	C 39pF	
C6	CC45SH1H560J	C 56pF	
C7	CE04W1A470Q	E 47 μ F 10V	
C8	CC45TH1H270J	C 27pF	

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
C9	CC45TH1H150J	C 15pF		C126	CE04W1A470Q	E 47μF 10V	
C10	CC45TH1H180J	C 18pF		C127	CC45SL1H390J	C 39pF	
C12	CE04W1A470Q	E 47μF 10V		C128	CC45SL1H070D	C 7pF ±0.5pF	
C14	CC45UJ1H680J	C 68pF		C129	CC45CH1H0R5C	C 0.5pF ±0.25pF	
C15	CC45UJ1H100D	C 10pF ±0.5pF		C130	CE04W1C470M	E 47μF 16V	
C16	CC45TH1H150J	C 15pF			E23-0046-04	Square terminal	
C18	CC45TH1H220J	C 22pF			E40-0273-05	Mini connect wafer 2P	
C19	CE04W1A470Q	E 47μF 10V			E40-0573-05	Mini connect wafer 5P	
C20	CC45UJ1H680J	C 68pF			E40-0673-05	Mini connect wafer 6P	
C21	CC45UJ1H330J	C 33pF			E40-0873-05	Mini connect wafer 8P	
C23	CC45TH1H150J	C 15pF			J31-0502-04	PC Board collar	
C24	CC45TH1H080D	C 8pF ±0.5pF			J42-0404-05	PC Board bush	
C25	CC45TH1H120J	C 12pF					
C26	CE04W1A470Q	E 47μF 10V		L1~5	L40-1511-03	Ferri-inductor 150μH	
C28	CC45TH1H330J	C 33pF		L6	L40-4701-03	Ferri-inductor 47μH	
C29	CC45TH1H150J	C 15pF		L7	L40-1511-03	Ferri-inductor 150μH	
C30	CC45TH1H270J	C 27pF		L8	L40-1592-02	Ferri-inductor 1.5μH	
C31	CC45TH1H330J	C 33pF		L9,10	L40-1092-02	Ferri-inductor 1.0μH	
C32	CC45UJ1H220J	C 22pF		L11	L40-1292-02	Ferri-inductor 1.2μH	
C34	CE04W1A470Q	E 47μF 10V		L12~17	L40-1511-03	Ferri-inductor 150μH	
C36	CC45UJ1H220J	C 22pF		L18	L40-1011-03	Ferri-inductor 100μH	
C37	CC45UJ1H050C	C 5pF ±0.25pF		L19	L40-1511-03	Ferri-inductor 150μH	
C38	CC45CH1H100D	C 10pF ±0.5pF		L20~22	L40-2701-03	Ferri-inductor 27μH	
C39	CC45CH1H020C	C 2pF ±0.25pF		L23	L40-4711-03	Ferri-inductor 470μH	
C41,43	C91-0456-05	C 0.047μF 25V		L24,25	L40-1511-03	Ferri-inductor 150μH	
C44	CC45SL1H151J	C 150pF		L26	L40-1001-03	Ferri-inductor 10μH	
C45	CC45SL1H271J	C 270pF		L27	L40-4711-03	Ferri-inductor 470μH	
C46	CC45SL1H121J	C 120pF		L28	L40-2701-03	Ferri-inductor 27μH	
C48	CC45CH1H100D	C 10pF ±0.5pF		L29	L40-1511-03	Ferri-inductor 150μH	
C49	CC45SL1H470J	C 47pF					
C52	CC45RH1H390J	C 39pF		T1	L32-0193-05	OSC coil	
C53	CC45RH1H560J	C 56pF		T2	L32-0195-05	OSC coil	
C65	CC45RH1H470J	C 47pF		T3	L32-0196-05	OSC coil	
C66	CC45RH1H220J	C 22pF		T4	L32-0197-05	OSC coil	
C67	CC45RH1H470J	C 47pF		T5	L32-0198-05	OSC coil	
C70	CC45RH1H100D	C 10pF ±0.5pF		T6	L34-0529-05	Trap coil 8.83M	
C71	CC45SL1H050D	C 5pF ±0.5pF		T7	L34-0709-05	Tuning coil 10M	
C75	CC45RH1H330J	C 33pF		T8	L34-0710-05	Tuning coil 20M	
C76	CC45RH1H150J	C 15pF		T9	L34-0712-05	Tuning coil	
C77	CC45RH1H330J	C 33pF		T10	L34-0713-05	Tuning coil	
C80	CC45RH1H150J	C 15pF		T11	L34-0711-05	Tuning coil	
C81	CC45RH1H040C	C 4pF ±0.25pF		T12	L34-0716-05	Tuning coil	
C82	CC45RH1H150J	C 15pF		T13	L34-0715-05	Tuning coil	
C85	CC45RH1H100D	C 10pF ±0.5pF		T14	L34-0714-05	Tuning coil	
C86	CC45SL1H050D	C 5pF ±0.5pF		T15	L34-0757-05	Tuning coil	
C88	CC45CH1H010C	C 1pF ±0.25pF		T16	L34-0718-05	Tuning coil	
C89	CC45CH1H050C	C 5pF ±0.25pF		T17	L34-0717-05	Tuning coil	
C100,101	CC45SL1H221J	C 220pF		VR1	R12-5014-05	Trim. pot 100kΩ	
C102	CQ92M1H122K	ML 0.0012μF			R92-0150-05	Short jumper	
C103	CC45SL1H330J	C 33pF					
C104,105	CC45SL1H680J	C 68pF					
C106	CC45SL1H330J	C 33pF					
C108,109	C91-0456-05	C 0.047μF 25V					
C110	CC45SL1H390J	C 39pF					
C111	CC45SL1H271J	C 270pF					
C112	C91-0456-05	C 0.047μF 25V					
C113	CE04W1A101Q	E 100μF 10V					
C114	C91-0456-05	C 0.047μF 25V					
C115	CE04W1A470Q	E 47μF 10V					
C120	C91-0456-05	C 0.047μF 25V					
C121	CQ92M1H102K	ML 0.001μF					
C122	CQ92M1H104K	ML 0.1μF					
C123	C91-0456-05	C 0.047μF 25V					
C124	CE04W1A101Q	E 100μF 10V					

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks
FILTER UNIT (X51-1240-00) S TYPE			
C2	CC45SL2H221J	C 220pF 500V	
C3	C91-0456-05	C 0.047μF 25V	
C4	CC45CH1H680J	C 68pF	
C5	CC45CH2H030C	C 3pF ±0.25pF 500V	
C7	C91-0456-05	C 0.047μF 25V	
C8	CE04W1H010	E 1μF 50V	
C10	CE04W1HR47	E 0.47μF 50V	
C11	C91-0456-05	C 0.047μF 25V	
C13	CE04W1C100	E 10μF 16V	
C18	CE04W1C221	E 220μF 16V	
C19	C91-0456-05	C 0.047μF 25V	
C23	CM93D2H561J	MC 560pF 500V	
C24,25	CM93D2H122J	MC 0.0012μF 500V	
C26	CM93D2H821J	MC 820pF 500V	
C27	CC45CH2H151J	C 150pF 500V	
C28	CC45SL2H181J	C 180pF 500V	
C29	CM93D2H621J	MC 620pF 500V	
C30	CC45CH2H151J	C 150pF 500V	
C31	CC45SL2H181J	C 180pF 500V	
C32,33	CC45CH2H121J	C 120pF 500V	
C34	CM93D2H471J	MC 470pF 500V	
C35	CC45CH2H680J	C 68pF 500V	
C36	CC45CH2H151J	C 150pF 500V	
C37	CC45SL2H221J	C 220pF 500V	
C38	CC45CH2H121J	C 120pF 500V	
C39	CC45CH2H101J	C 100pF 500V	
C40	CC45CH2H151J	C 150pF 500V	
C41	CC45SL2H181J	C 180pF 500V	
C42	CC45CH2H680J	C 68pF 500V	
C43	CC45CH2H820J	C 82pF 500V	
C44	CC45CH2H560J	C 56pF 500V	
C45	CC45CH2H680J	C 68pF 500V	
C46	CC45CH2H101J	C 100pF 500V	
C47	CC45CH2H121J	C 120pF 500V	
C48	CC45CH2H560J	C 56pF 500V	
C49	CC45CH2H680J	C 68pF 500V	
C50	CC45CH2H470J	C 47pF 500V	
C51	CC45CH2H390J	C 39pF 500V	
C52,53	CC45CH2H820J	C 82pF 500V	
C54,55	CC45CH2H680J	C 68pF 500V	
C56	CC45CH2H820J	C 82pF 500V	
C57,58	CC45CH2H151J	C 150pF 500V	
C59,60	CC45CH2H101J	C 100pF 500V	
TC1	C05-0043-05	Ceramic trimmer 20pF	
	E04-0154-05	Coax. connector	
	E23-0046-04	Square terminal	
	E40-0273-05	Mini connect wafer 2P	
	E40-0373-05	Mini connect wafer 3P	
	E40-0973-05	Mini connect wafer 9P	
	E40-1273-05	Mini connect wafer 12P	
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
	J31-0502-04	PC Board collar	
	J42-0404-05	PC Board bush	
L1~3	L34-0826-05	Filter coil (A)	
L4,5	L34-0827-05	Filter coil (B)	
L6,7	L34-0828-05	Filter coil (C)	
Ref.No.	Parts No.	Description	Re- marks
L8,9	L34-3001-15	Filter coil (D)	
L10,11	L34-0830-05	Filter coil (E)	
L12	L40-1021-03	Ferri-inductor 1mH	☆
L13	L34-0989-05	Filter coil (G)	
L14,15	L40-1021-03	Ferri-inductor 1mH	
L16,17	L40-1511-03	Ferri-inductor 150μH	
L18	L39-0406-05	Detector coil	
L19	L40-1511-03	Ferri-inductor 150μH	
L20,21	L34-0988-05	Filter coil (F)	☆
L22	L34-0989-05	Filter coil (G)	☆
R23	RC05GF2H151J	Solid 150Ω 1/2W	
VR1	R12-4016-05	Trim. pot 50kΩ(B)	
VR2	R12-3025-05	Trim. pot 10kΩ(B)	
VR3	R12-4016-05	Trim. pot 50kΩ(B)	
VR4	R12-0042-05	Trim. pot 500Ω(B)	
VR5	R12-1020-05	Trim. pot 1kΩ(B)	
	R92-0150-05	Short jumper	
RL1	S51-4402-05	Relay (LZN403)	
FILTER UNIT (X51-1250-00) V TYPE			
C1	CC45SL2H102JTD	C 0.001μF 500V	
C2	CC45SL2H821JTD	C 820pF 500V	
C3	CC45SL2H331J	C 330pF 500V	
C4	CC45SL2H561JTD	C 560pF 500V	
C5	CC45SL2H331J	C 330pF 500V	
C6	CC45SL2H561JTD	C 560pF 500V	
C7	CC45SL2H331J	C 330pF 500V	
C8	CC45CH2H131J	C 130pF 500V	
C9	CC45SL2H331J	C 330pF 500V	
C10	CC45SL2H161J	C 160pF 500V	
C11	CC45SL2H151J	C 150pF 500V	
C12	CC45SL2H241J	C 240pF 500V	
C13	CC45CH2H121J	C 120pF 500V	
C14	CC45CH2H820J	C 82pF 500V	
C15	CC45SL2H161J	C 160pF 500V	
C16	CC45CH2H820J	C 82pF 500V	
C17	CC45CH2H750J	C 75pF 500V	
C19	CC45CH1H100D	C 10pF ±0.5pF	
C20	CC45CH1H101J	C 100pF 500V	
C21	CC45SL2H221J	C 220pF 500V	
C22	C91-0456-05	C 0.047μF 25V	
C23	CC45SL2H151J	C 150pF 500V	
C26	C91-0456-05	C 0.047μF 25V	
C27	CE04W1HR47	E 0.47μF 50V	
C29	CE04W1H010	E 1μF 50V	
C30	CC45CH2H150J	C 15pF 500V	
C33	CE04W1C470Q	E 47μF 16V	
C34	CE04W1C221Q	E 220μF 16V	
C35	C91-0456-05	C 0.047μF 25V	
TC1	C05-0043-05	Ceramic trimmer 20pF	
	E04-0154-05	Coax. connector	
	E23-0046-04	Square terminal	
	E40-0273-05	Mini connect wafer 2P	
	E40-0373-05	Mini connect wafer 3P	

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
	E40-0673-05	Mini connect wafer 6P		C11	CE04W1A101Q	E 100 μ F 10V	
	E40-1073-05	Mini connect wafer 10P		C12	C91-0456-05	C 0.047 μ F 25V	
	J31-0502-04	PC Board collar		C13	CC45SL1H470J	C 47pF	
	J42-0404-05	PC Board bush		C14	CC45CH1H390J	C 39pF	
	J61-0019-05	Vinyle tie		C15	CC45CH1H101J	C 100pF	
L1,2	L34-0826-05	Filter coil		C16	CC45CH1H270J	C 27pF	
L3,4	L34-0827-05	Filter coil		C17	C91-0456-05	C 0.047 μ F 25V	
L5	L34-0828-05	Filter coil		C18	CC45SL1H221J	C 220pF	
L6	L34-0724-05	Filter coil		C19	CC45SL1H220J	C 22pF	
L7,8	L34-0829-05	Filter coil		C20	CC45SL1H050C	C 5pF \pm 0.25pF	
L9,10	L34-0830-05	Filter coil		C21,22	C91-0456-05	C 0.047 μ F 25V	
L11	L39-0404-05	Detector coil		C23	CE04W1A101Q	E 100 μ F 10V	
L12,13	L40-1511-03	Ferri-inductor 150 μ H		C24	CC45SL1H101J	C 100pF	
L14,15	L40-1021-03	Ferri-inductor 1mH		C25	CC45SL1H270J	C 27pF	
L16,17	L40-1511-03	Ferri-inductor 150 μ H		C26	CC45SL1H560J	C 56pF	
R4	RC05GF2H103K	Solid 10k Ω 1/2W		C27	CC45SL1H270J	C 27pF	
VR1	R12-3025-05	Trim. pot 10k Ω (B)		C28~30	CC45SL1H470J	C 47pF	
VR2,3	R12-4016-05	Trim. pot 50k Ω (B)		C31,33	C91-0456-05	C 0.047 μ F 25V	
VR4	R12-1020-05	Trim. pot 1k Ω (B)		C34	CC45SL1H101J	C 100pF	
	R92-0150-05	Short jumper	☆	C35	CC45SL1H221J	C 220pF	
	S01-2424-05	Rotary switch		C36	CC45SL1H101J	C 100pF	
	S51-4402-05	Relay (LZN403)		C38,39	C91-0456-05	C 0.047 μ F 25V	
PROCESSOR UNIT (X54-1550-00)				C40	CC45SL1H150J	C 15pF	
C1~4	CE04W1H010Q	E 1 μ F 50V		C41,42	C91-0456-05	C 0.047 μ F 25V	
C5	CE04W1H3R3Q	E 3.3 μ F 50V		C43	CQ92M1H103K	ML 0.01 μ F	
C6,7	CE04W1H010Q	E 1 μ F 50V		C44,45	C91-0456-05	C 0.047 μ F 25V	
C8	CE04W1H4R7Q	E 4.7 μ F 50V		C46	CE04W1A101Q	E 100 μ F 10V	
C9	CE04W1C100Q	E 10 μ F 16V		C47	CE04W0J221Q	E 220 μ F 6.3V	
C10	CE04W1H4R7Q	E 4.7 μ F 50V		C48	CE04W1V100Q	E 10 μ F 35V	
C11	CE04W1C470Q	E 47 μ F 16V		C49	CQ92M1H103K	ML 0.01 μ F	
	E23-0047-04	Square terminal		C50,51	CE04W1V100Q	E 10 μ F 35V	
	E40-0273-05	Mini connect wafer 2P		C52	C91-0456-05	C 0.047 μ F 25V	
	E40-0473-05	Mini connect wafer 4P		C53	CE04W1V100Q	E 10 μ F 35V	
	E40-0873-05	Mini connect wafer 8P		C55,57,62	C91-0456-05	C 0.047 μ F 25V	
VR1,S1	R19-3408-05	Pot. with SW 10k Ω (A),10k Ω (B)	☆	TC1	C05-0035-05	Ceramic trimmer 50pF	
VR2	R12-5406-05	Pot. 100k Ω	☆		E31-0466-05	Tape cable	
	R92-0150-05	Short jumper			E40-0273-05	Mini connect wafer 2P	
COUNTER UNIT (X54-1560-00)					E40-0373-05	Mini connect wafer 3P	
C1	CC45CH1H330J	C 33pF			E40-1273-05	Mini connect wafer 12P	
C2	CC45SL1H391J	C 390pF			E40-1373-05	Mini connect wafer 13P	
C3	CC45CH1H470J	C 47pF			J31-0502-04	PC Board collar	
C4	C91-0456-05	C 0.047 μ F 25V			J42-0404-05	PC Board bush	
C5	CC45SL1H150J	C 15pF		L1~4	L40-4711-03	Ferri-inductor 470 μ H	
C6	CC45SL1H020C	C 2pF \pm 0.25pF		L5,6	L40-4701-03	Ferri-inductor 47 μ H	
C7	CC45SL1H100D	C 10pF \pm 0.5pF		L7,8	L40-4711-03	Ferri-inductor 470 μ H	
C9,10	C91-0456-05	C 0.047 μ F 25V		L9,10	L40-2211-03	Ferri-inductor 220 μ H	
				L11,12	L40-1511-03	Ferri-inductor 150 μ H	
				L13	L40-1011-04	Ferri-inductor 100 μ H	
				T1	L19-0305-05	OSC trans	
				X1	L77-0482-05	Crystal 10MHz	
				R68	RC05GF2H151K	Solid 150 Ω 1/2W	
				RB1	R90-0522-05	Resistor block 47k Ω X6	
				RB2,3	R90-0521-05	Resistor block 47k Ω X7	
				RB4	R90-0522-05	Resistor block 47k Ω X6	
					R92-0150-05	Short jumper	

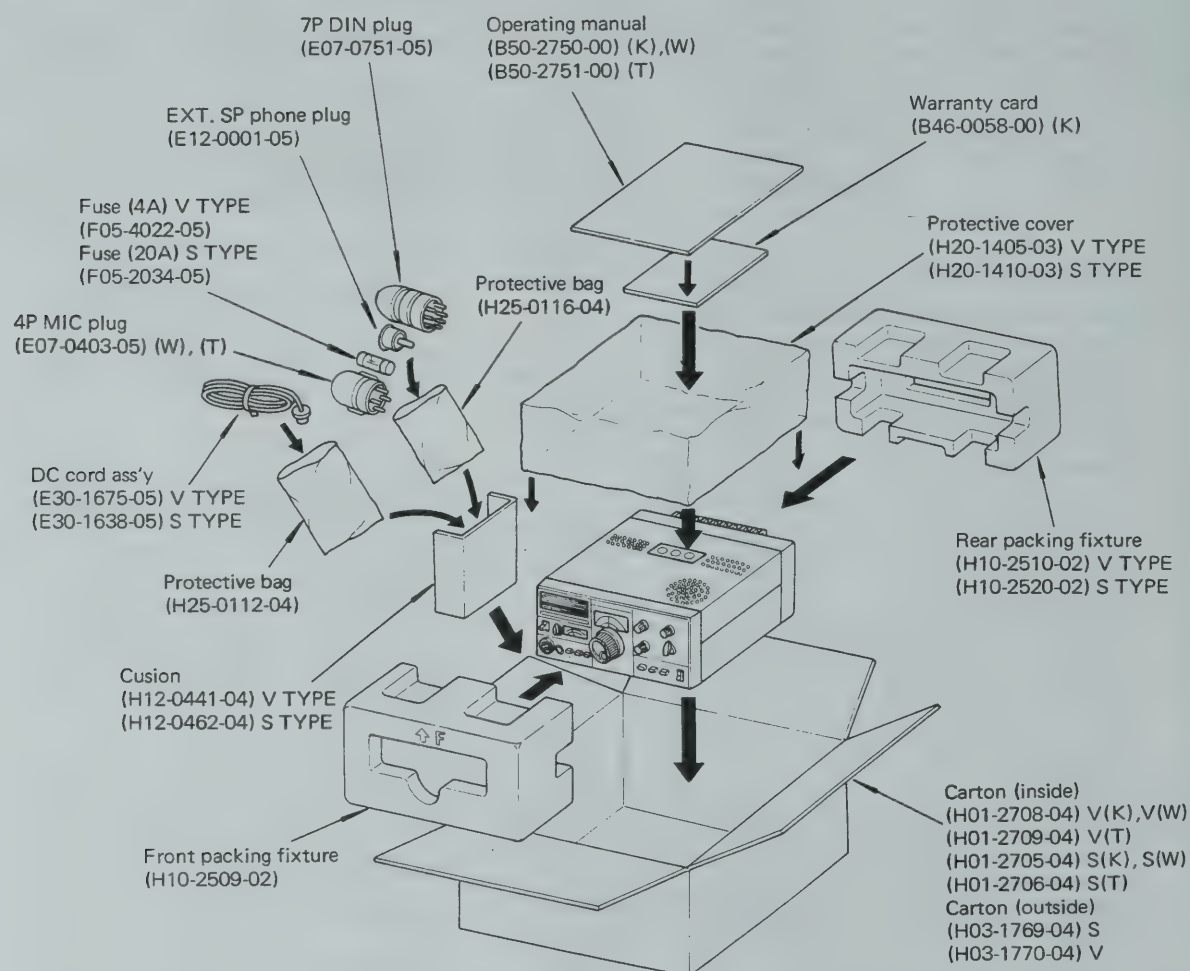
PARTS LIST

Ref.No.	Parts No.	Description	Re- marks
FINAL UNIT (X-56-1300-00) V TYPE			
C1,3	C91-0456-05	C 0.047 μ F 25V	
C5,6,10	C91-0456-05	C 0.047 μ F 25V	
C12~14	C91-0456-05	C 0.047 μ F 25V	
C16,18	C91-0456-05	C 0.047 μ F 25V	
C19	CE04W1C101	E 100 μ F 16V	
C20	CE04W1C100	E 10 μ F 16V	
C21	CC45SL2H151J	C 150pF 500V	
C22	CC45SL1H471J	C 470pF	
C23	CC45SL2H680J	C 68pF 500V	
C24	C91-0456-05	C 0.047 μ F 25V	
	E23-0401-05	Round terminal	
	F01-0717-13	Heat sink A	☆
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
L1	L40-4701-03	Ferri-inductor 47 μ H	
L3,6	L33-0032-05	RFC 3 μ H	
L7	L33-0617-05	RFC	☆
T1	L19-0315-15	Wide bandwidth trans	
T2	L19-0306-15	Output trans	☆
R6,7	RC05GF2H560J	Solid 56 Ω 1/2W	
R11	RC05GF2H4R7J	Solid 4.7 Ω 1/2W	
R17,18	RC05GF2H560J	Solid 56 Ω 1/2W	
VR1	R12-0412-05	Trim. pot 200 Ω (B)	
	R92-0150-05	Short jumper	
FINAL UNIT (X56-1350-00) S TYPE			
C1	C91-0455-05	C 0.01 μ F 25V	
C3,4	C91-0456-05	C 0.047 μ F 25V	
C6	C91-0455-05	C 0.01 μ F 25V	
C11	C91-0456-05	C 0.047 μ F 25V	
C12	CE04W1E100	E 10 μ F 25V	
C13,14	C91-0456-05	C 0.047 μ F 25V	
C15	CM93AD2H151J	MC 150pF 500V	
C18,19	C91-0456-05	C 0.047 μ F 25V	
C20	CE04W1E101	E 100 μ F 25V	
C21,24	C91-0456-05	C 0.047 μ F 25V	
C25	CE04W1E100	E 10 μ F 25V	
C33,34	C91-0448-05	Laminated cap. 0.68 μ F	☆
C35	C91-0456-05	C 0.047 μ F 25V	
C37	CE04W1H101Q	E 100 μ F 50V	
C38	C91-0456-05	C 0.047 μ F 25V	
C39	CM93AD2H271J	MC 270pF 500V	
C40	CM93AD2H331J	MC 330pF 500V	
C41~43	C91-0455-05	C 0.01 μ F 25V	
C44	CM93AD2H271J	MC 270pF 500V	
C47	CM93AD2H331J	MC 330pF 500V	
C50	CC45SL1H220J	C 22pF	
C51,52	C91-0455-05	C 0.01 μ F 25V	
C53	CC45SL1H471J	C 470pF	
	E04-0152-05	UHF type receptacle	
	E08-0271-05	DC socket FAN	
Ref.No.	Parts No.	Description	Re- marks
	E23-0043-04	Antenna earth lug	
	E23-0046-04	Square terminal	
	E23-0401-05	Round terminal	
	E23-0420-05	Earth lug	
	E40-0273-05	Mini connect wafer 2P	
	E40-0373-05	Mini connect wafer 3P	
	F01-0735-05	Heat sink	
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
	J31-0503-05	Bees	
	J32-0730-04	Hex. boss	☆
L1	L40-1001-04	Ferri-inductor 10 μ H	
L3,4	L33-0032-05	RFC	
L7	L33-0617-05	RFC	
L8	L33-0025-05	RFC	
L9	L33-0625-15	RFC	☆
L10~12	L40-1011-04	Ferri-inductor 100 μ H	
L13,14	L40-1021-03	Ferri-inductor 1mH	
T1	L19-0315-25	Wide bandwidth trans	
T2	L19-0311-05	Input trans	☆
T3	L19-0313-15	NF trans	☆
T4	L19-0312-05	Output trans	☆
	N19-0611-04	Washer	☆
R3	RC05GF2H4R7J	Solid 4.7 Ω 1/2W	
R12,13	RC05GF2H101J	Solid 100 Ω 1/2W	
R14~17	RS14AB3A3R9J	Metal film 3.9 Ω 1W	
R18,19	RC05GF2H150J	Solid 15 Ω 1/2W	
R20~23	RC05GF2H5R6J	Solid 5.6 Ω 1/2W	
VR1,2	R12-0058-05	Trim. pot 470 Ω (B)	
	R92-0150-05	Short jumper	
TM1	S59-1404-05	Thermostat Heat sink	
TM2	S59-1403-05	Thermostat core	
VFO ASS'Y UNIT (X60-1160-00)			
	B01-0621-04	Dial escutcheon	
	B08-4301-04	Dial back board	☆
	B10-0634-04	Front glass (A)	☆
	B20-0811-04	Dial scale (B) 25K	
	B20-0817-04	Dial scale (A) 500K	☆
	B42-1645-04	Seal Bottom	
	B42-1671-04	Seal Top	
	G01-0804-04	Coil spring	
	J19-1317-04	Diode holder	
	K21-0722-04	Main knob	
	N19-0613-04	washer B	
	X40-1170-00	VFO unit	
	X54-1450-01	INDICATOR unit	☆

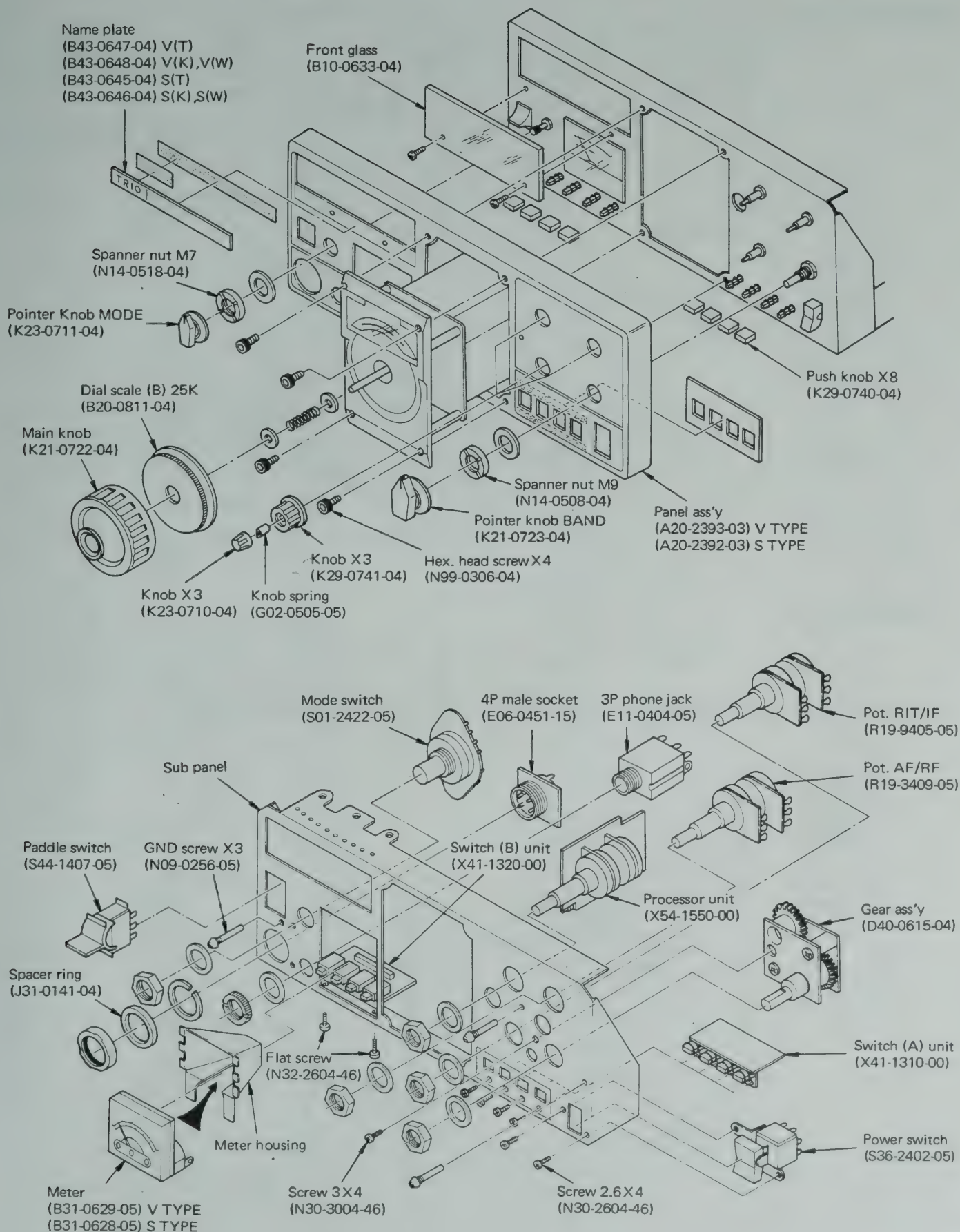
PARTS LIST/PACKING

Ref.No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
VFO UNIT (X40-1170-00)				TC1	C05-0009-15	Ceramic trimmer 6pF	
C2	C91-0456-05	C 0.047 μ F 25V		TC2	C05-0013-15	Ceramic trimmer 20pF	
C4	CC45RG1H030C	C 3pF ± 0.25 pF			C02-0019-05	Variable cap.	☆
C5	CC45PG1H020C	C 2pF ± 0.25 pF			D40-0614-05	Dial mechanism ass'y	☆
C6	C91-0456-05	C 0.047 μ F 25V			E40-0574-05	Mini connect wafer 5P	
C7	CC45LG1H151J	C 150pF		L1	L32-0628-05	OSC coil	☆
C9	CC45LG1H121J	C 120pF		L2	L33-0025-05	Choke coil 1 μ H	
C12	CC45LG1H680J	C 68pF		L3	L32-0629-05	OSC coil (C)	☆
C13	CC45LG1H220J	C 22pF		L4	L32-0609-05	OSC coil (B)	
C14	CC45CG1H100D	C 10pF ± 0.5 pF		L5	L40-1021-03	Ferri-inductor 1mH	
C15	CC45LG1H151J	C 150pF		L6	L40-4711-03	Ferri-inductor 470 μ H	
C16	CC45LG1H151J	C 150pF		L7	L40-1021-03	Ferri-inductor 1mH	
C17	CC45CH1H020C	C 2pF ± 0.25 pF		L8	L40-1501-03	Ferri-inductor 15 μ H	
C18	C91-0456-05	C 0.047 μ F 25V		L9~11	L40-4711-03	Ferri-inductor 470 μ H	
C21	CC45SL1H390J	C 39pF			R92-0150-05	Short jumper	
C22	CC45CH1H100D	C 10pF ± 0.5 pF					
C23	CC45SL1H390J	C 39pF					
C24	C91-0456-05	C 0.047 μ F 25V					

PACKING

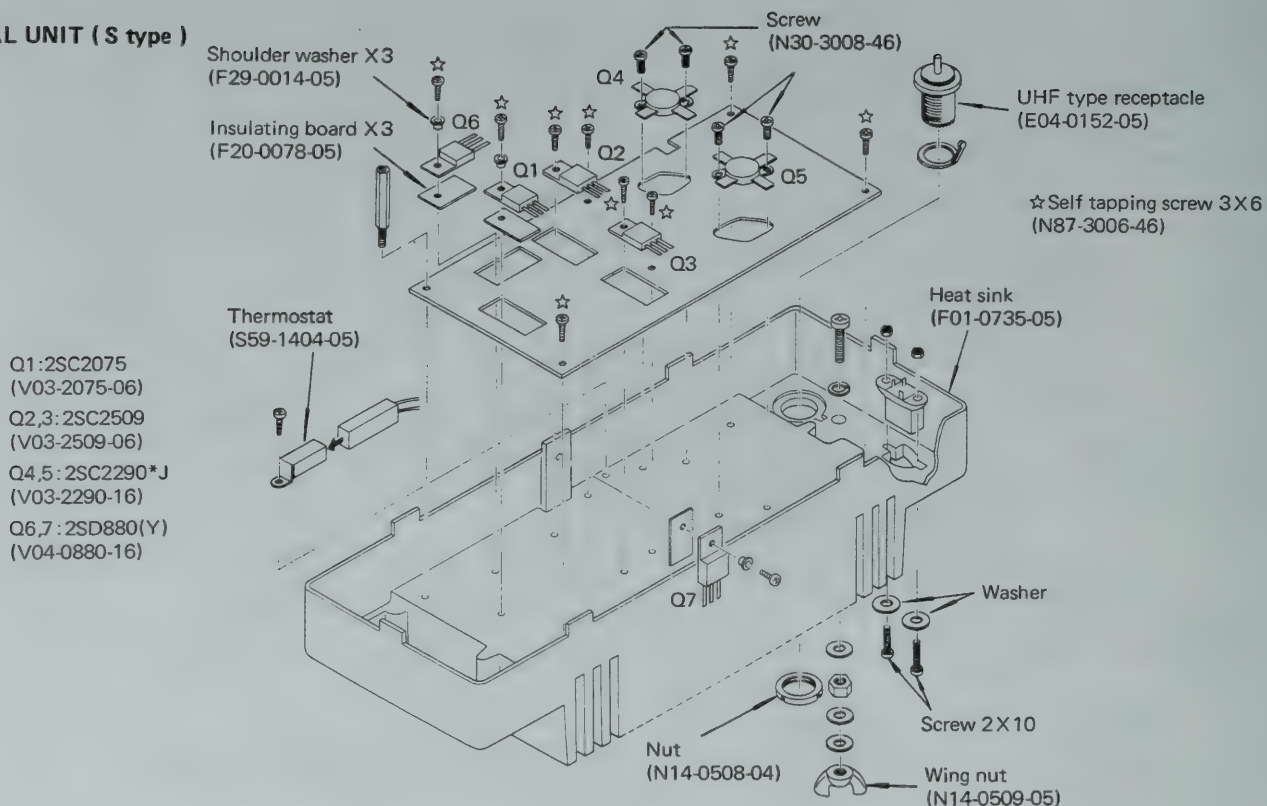


DISASSEMBLY

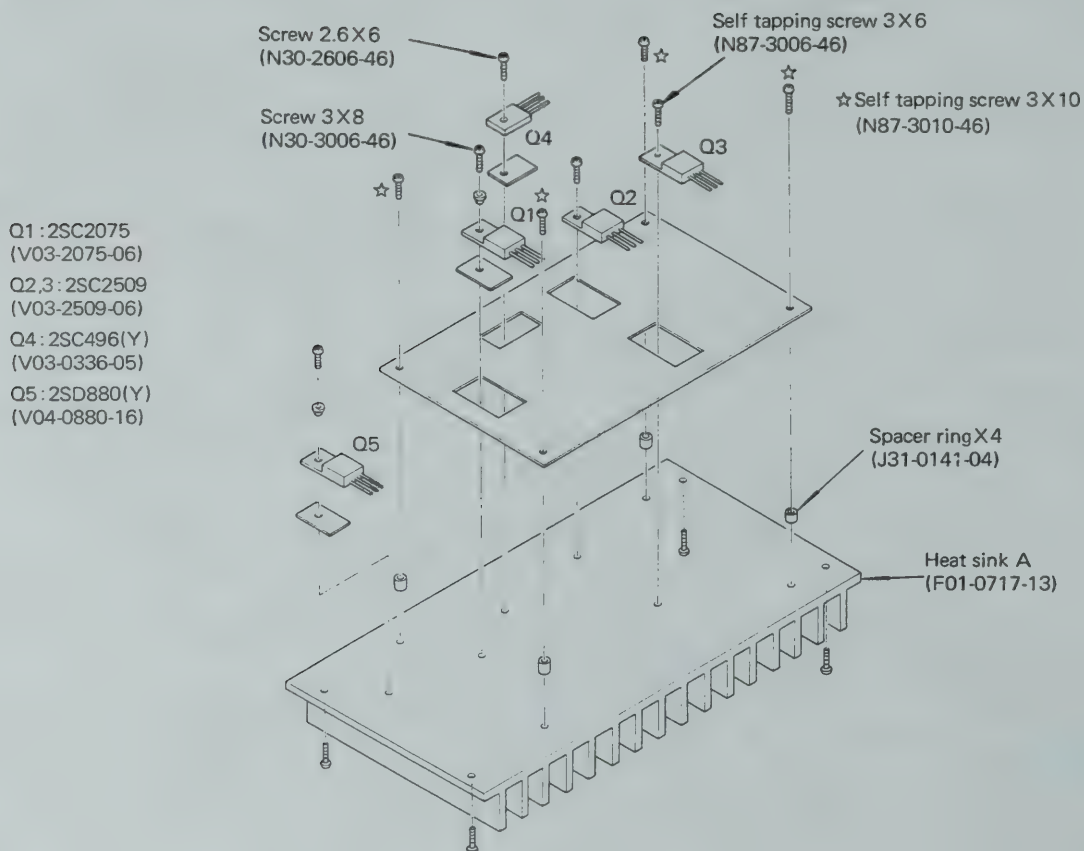


DISASSEMBLY

FINAL UNIT (S type)

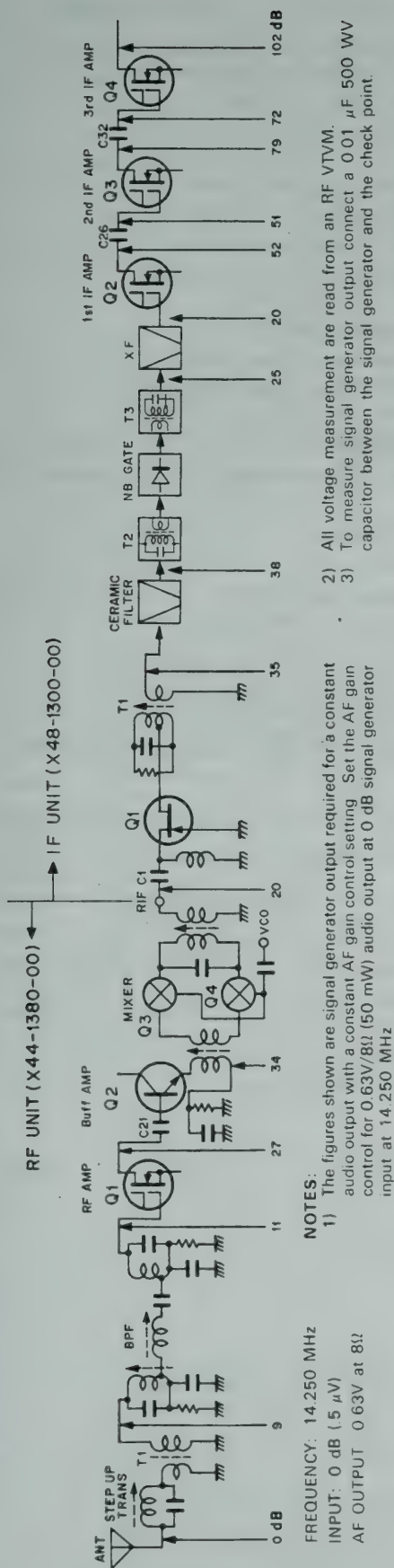


FINAL UNIT (V type)

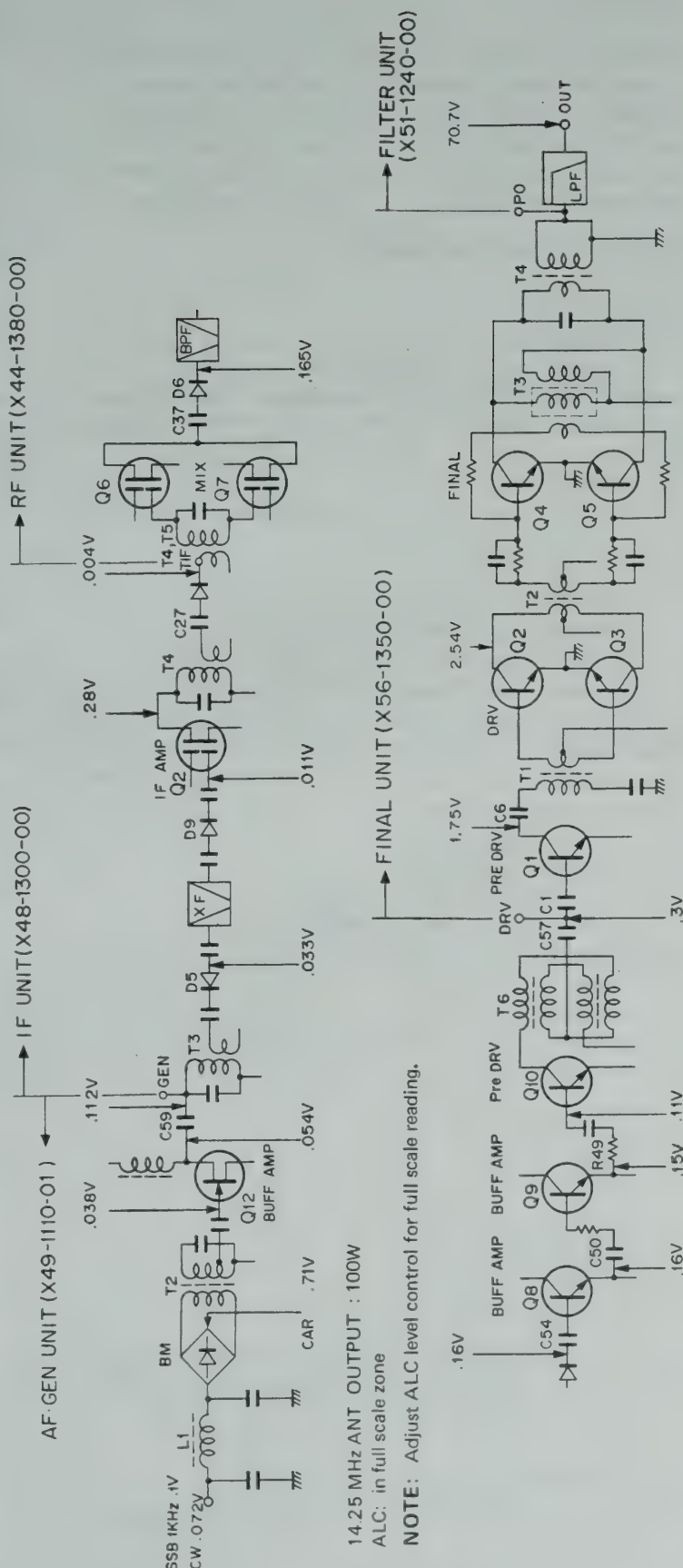


LEVEL DIAGRAM

RECEIVER SECTION



TRANSMITTER SECTION (S TYPE)



ADJUSTMENTS

GENERAL

Adjustment procedures for this transceiver are classified into formal adjustments requiring a full service bench and simplified adjustment using a VTVM, AF and RF VTVM, AG, and AF and RF dummy load.

Complete adjustment also requires a frequency counter, SSG, sweep generator, etc.

TEST EQUIPMENT REQUIRED

1. VTVM or DVM

- 1) Input resistance: More than $1M\Omega$
- 2) Voltage range: 1.5 to 1000V AC/DC

NOTE : A high-precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. DC current meter

- 1) Current range: 100mA, 200mA, 2A, 10A, High-precision current meter may be used.

3. RF VTVM

- 1) Input impedance: $1M\Omega$ and less than 3 pF, min.
- 2) Voltage range: 10mV to 300V
- 3) Frequency range: 50MHz or greater

NOTE: During adjustment special accuracy is not required (such as input level or PLL circuit carrier oscillator output), a VTVM or VOM may substitute for an RF VTVM by measuring through the output of a detector as shown in item 14.

4. AF VTVM

- 1) Frequency range: 50Hz to 10kHz
- 2) Input resistance: $1M\Omega$ or greater
- 3) Voltage range: 10mV to 30V

5. AF GENERATOR (AG)

- 1) Frequency range: 200Hz to 5kHz
- 2) Output: 2mV~1V, low distortion

6. AF DUMMY LOAD

- 1) Impedance: 8Ω
- 2) Dissipation: 3W or greater

7. RF DUMMY LOAD

- 1) Impedance: 50Ω , 150Ω
- 2) Dissipation: 100W continuous or greater
- 3) Frequency limits: 1.8 to 30MHz

The above-mentioned instruments may be used for simplified adjustment. For complete, precise adjustment, the following instruments are also necessary.

8. OSCILLOSCOPE

Requires high sensitivity, and external synchronization capability.

9. SWEEP GENERATOR

- 1) Center frequency: 8.83MHz
- 2) Frequency deviation: Maximum ± 5 kHz
- 3) Output voltage: More than 0.1V
- 4) Sweep rate: At least 0.5 sec/cm

10. Standard Signal Generator (SSG)

- 1) Frequency range: 1.8 to 30MHz
- 2) Output: -20 dB/0.1 μ V~120dB/1V

NOTE: Generator must be frequency stable.

11. FREQUENCY COUNTER

- 1) Minimum input voltage: 50mV
- 2) Frequency range: Greater than 40MHz

12. NOISE GENERATOR

Must generate ignition noise containing harmonics beyond 30MHz.

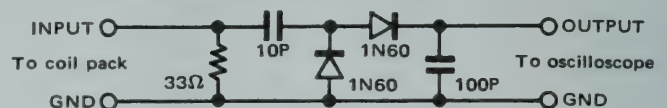
13. Spectrum analyzer

- 1) Frequency range: 100K to 110MHz
- 2) Bandwidth: 1kHz to 3MHz

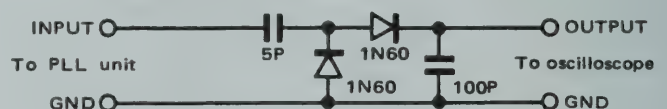
NOTE: R-1000 receiver may be used.

14. Detector

- 1) For adjustment of TX BPF



- 2) For adjustment of PLL unit BPF



15. Directional coupler

16. FIX-CH adjusting crystal element

- 1) 5.750MHz (center: 250kHz)

REFERENCE

Japanese "SSG"	American "SG"
-6dB	.025 μ V
0dB	.05 μ V
6dB	.1 μ V
12dB	.2 μ V
24dB	.8 μ V
30dB	.158 μ V
40dB	.50 μ V
50dB	.158 μ V
60dB	.500 μ V
70dB	.158mV
80dB	.5mV
90dB	.158mV
100dB	.50mV
120dB	.05V

ADJUSTMENTS

PREPARATION

Unless otherwise specified, set the controls as follows.

POWERON

AF GAINCOUNTERCLOCKWISE

RF GAINFULL CLOCKWISE

RIT SW.OFF

IF SHIFTCENTERED

NODESSB

SEND/RECREC

NBOFF

FIX./VFOVFO


VOX/MAN. . . .MAN

PROC.OFF

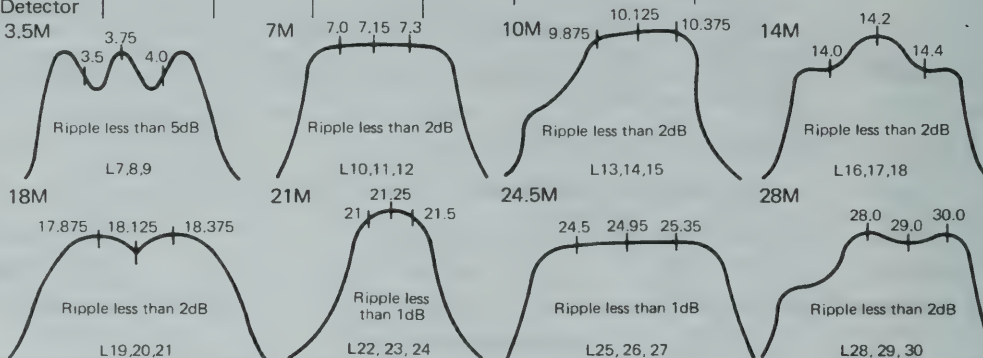

WIDE/NARWIDE

(V): TS-130 V type


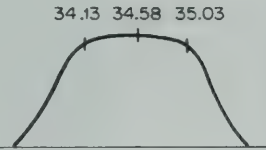
(S): TS-130 S type

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Reference	
1. Power Supply voltage		DC VTVM	AF-GEN	J4,7P	AF-GEN		3.8V	
				J4,4P		VR3	9V	
				J4,5P			50V	
				J4,10P	AF-GEN	VR2	2.8V	
	STBY:SEND		Filter	AVB	Filter	VR4(V) VR5(S)	11.0V	
2. CAR 1) CAR output 2) Freq. RX	BAND:3.5	RF VTVM	AF-GEN	J3,2P	CAR	T1	0.3Vrms	0.3V±1dB
	STBY:REC							
	IF SHIFT: Centered	Frequency counter				TC2	8.82850MHz	
	MODE:SSB					TC1	8.83150MHz	
3. IF SHIFT	MODE:REV	Frequency counter	AF-GEN	J3,2P	CAR	VR2	8.83070MHz	RX and TX frequency no change.
	MODE:CW							
	STBY:SEND							
4. VFO 1) Output 2) 800Hz shift 3) Frequency tracking and check	VFO scale:250	RF VTVM	AF-GEN	J1,6P	VFO	TC2	0.2Vrms	0.2V±1dB rms 800±50 Hz
	MODE:CW					L4	Adjust for 800Hz higher than receive state.	
	STBY:SEND	Frequency counter				L3	5550.00 kHz ±200 Hz	Repeat this adjustment several times until the frequency is within specification.
	VFO:50							
	Set the CAL control to the index.							
	VFO scale: Approx. 450					TC1	5950.00 kHz ±200 Hz	
Set the CAL control calibrated under this VFO setting exactly to the index.								
Set the VFO main tuning to 5750.000kHz.								The 50 kHz point on the dial scale must be aligned to the index.
Under the above condition, set the CAL control to the index. Turn the main tuning, and set the calibrated CAL control to the index in the order of 0, 100, 200, 300, 400, and 500 to check frequency deviation at each 100 kHz point.							0 5.5MHz 100 5.6 200 5.7 300 5.8 400 5.9 500 6.0	Within ±2 kHz
Set the CAL control back to 250 under the above condition (do not turn excessively.), then further set back the CAL control to 0 with respect to the frequency at 250 to check The difference from the reference frequency.							Less than 400Hz	Backlash

ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specification/Remarks																																																				
		Instruments	Unit	Terminal	Unit	Parts	Reference																																																					
5. RIT	1) Adjust VFO frequency to 5.75MHz 2) RIT control: Centered	Frequency counter	AF-GEN	J1,6P	AF-GEN	VR1	Alternate RIT ON and OFF	1) No frequency change between RIT ON and OFF 2) More than ±1.5kHz variable RIT range																																																				
6. VCO	VFO BAND 250 3.5 250 7 250 14 250 18 250 21 500 29.0	DCVTVM Frequency counter	PLL	TP1	PLL	T1 T2 T3 T5 T4 —	3.5V 5.0V 4.0V 6.1V 3.75V 4.75V(check)	Oscillator level 1V+3dB,—1dB at J18, 1P on PLL unit																																																				
								<table><tr><th>VFO BAND</th><th>0</th><th>250</th><th>500</th><th></th></tr><tr><td>3.5</td><td>12.33M</td><td>(3.5V) 12.58M</td><td>12.83M</td><td></td></tr><tr><td>7.0</td><td>15.83M</td><td>(5.0V) 16.08M</td><td>16.33M</td><td>VCO Common</td></tr><tr><td>10.0</td><td>18.33M</td><td>19.08M</td><td>19.33M</td><td></td></tr><tr><td>14.0</td><td>22.83M</td><td>(4V) 23.08M</td><td>23.33M</td><td></td></tr><tr><td>21.0</td><td>29.83M</td><td>(3.75V) 30.08M</td><td>30.33M</td><td>VCO Common</td></tr><tr><td>24.5</td><td>33.33M</td><td>33.58M</td><td>33.83M</td><td></td></tr><tr><td>18.0</td><td>26.83M</td><td>(6.1V) 27.08M</td><td>27.33M</td><td>VCO Common</td></tr><tr><td>28.0</td><td>36.83M</td><td>37.08M</td><td>37.33M</td><td></td></tr><tr><td>28.5</td><td>37.33M</td><td>37.58M</td><td>37.83M</td><td></td></tr><tr><td>29.0</td><td>37.83M</td><td>38.08M</td><td>38.33M</td><td></td></tr><tr><td>29.5</td><td>38.33M</td><td>38.58M</td><td>38.83M</td><td></td></tr></table>	VFO BAND	0	250	500		3.5	12.33M	(3.5V) 12.58M	12.83M		7.0	15.83M	(5.0V) 16.08M	16.33M	VCO Common	10.0	18.33M	19.08M	19.33M		14.0	22.83M	(4V) 23.08M	23.33M		21.0	29.83M	(3.75V) 30.08M	30.33M	VCO Common	24.5	33.33M	33.58M	33.83M		18.0	26.83M	(6.1V) 27.08M	27.33M	VCO Common	28.0	36.83M	37.08M	37.33M		28.5	37.33M	37.58M	37.83M		29.0	37.83M
VFO BAND	0	250	500																																																									
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29.5	38.33M	38.58M	38.83M																																																									
Note():control voltage																																																												
7. TX BPF (RX BPF)	MODE:SSB STBY:SEND Make adjustments in the following sequence:3.5→7→10→14→18→21→24.5→28MHz. Disconnect connector J18 on the PLL unit and connect the sweep generator RF output to it. Connect the detector input to the DRV terminal on the RF unit.	Sweep generator, Oscilloscope, Detector	PLL RF	J18 DRV	RF	L7~30	Adjust coils for waveform as shown.																																																					
8. PLL BPF 1) BPF-A	STBY:REC Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D17 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit with a lead. Connect the sweep generator RF output to the J19, 3P (VFO) on the PLL unit. Connect the detector input to Q16 emitter on the PLL unit.	Detector, Oscilloscope, Sweep generator	PLL	Q16(E)	PLL	T9 T10 T11	Adjust T9~T11 for waveform as shown at right.																																																					

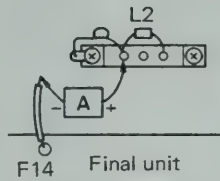
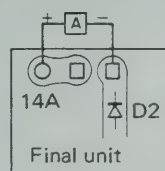
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
2) BPF-B	Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D24 and D27 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit with a lead. Connect the sweep generator RF output to the anode of D28 on the PLL unit via a 15pF capacitor. Detector input: Same as above	Detector, Oscilloscope, Sweep generator	PLL	Q16 (E)	PLL	T12 T13 T14 T7	Adjust T12~T14 for waveform as shown at right. Adjust T7 for maximum output.	
3) BPF-C	Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D20 and D27 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit. Sweep generator RF output: Same as above Detector input: Same as above					T15 T16 T17 T8	Adjust T15~T17 for waveform as shown at right. Adjust T8 for maximum output	
9. VFO.MIX spurious Note: This adjustment should be done after completing the BPF-A adjustment(or check).	Disconnect connector J17 on the PLL unit. Connect the cathode of D17 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit. VFO scale: 250 MODE: CW	Spectrum analyzer or monitor receiver	PLL	Q16 (E)	PLL	VR1	Adjust for minimum output at 14.99MHz.	Less than - 55dB
10. PLL-IF trap	Disconnect connector J17 on the PLL unit. Connect the SSG output 8.83MHz, 60dB to Q7 emitter on the PLL unit via a 0.01μF capacitor.	SSG, RF VTVM	PLL	Q7 (E) J18,1P	PLL	T6	Adjust for minimum output.	

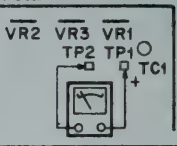
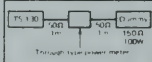
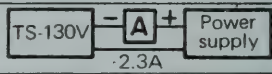
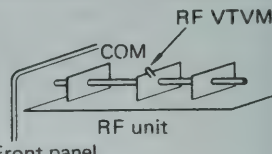
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
11. IF AMP	VFO:250 IF SHIFT: Centered VFO/FIX: VFO MODE:SSB BAND:14 AF GAIN:10 o'clock RF GAIN: Fully clock- wise Connect the SSG output 14.25MHz, - 6dB to the ANT terminal.	SSG, Oscillo- scope, AF VTVM, AF Dum- my load		SP	RF	T3 IF T1 T2 T3 T4 T5 T6	The slug of T3 should be turned counter- clockwise from the peak point to reduce audio output by 2dB. Adjust T1~T6 for maximum audio output.	
12. IF trap	1) BAND: 10MHz VFO: any fre- quency SSG: 8.83 MHz, 80dB	SSG, AF VTVM		SP	RF	L3 L4 L35	Adjust for minimum S-meter reading and AF output level. Repeat the procedure two or three times.	L3 and L4 should be adjusted while they are turned counterclockwise.
13. NB	BAND:10 VFO:250 NB SW:ON Connect the SSG output 10.25 MHz, 60dB to the ANT terminal.	DC VTVM, SSG	IF	TP (Q15 ©)	IF	T7 T8	Adjust for mini- mum DC voltage.	
	Disconnect the SSG output. Connect the noise genera- tor output to the ANT ter- minal. Set the noise ge- nerator output level to S5~7.	Noise generator			IF	T2	Turned counter- clockwise 90 de- gree from the peak point. If adequate effect is not obtained, repeat the adjust- ment several times.	T2 has been adjusted for the peak point in item 11. The NB must provide adequate effect.
14. Carrier balance (IF SHIFT)	IF SHIFT: Centered RF GAIN: Counterclock- wise	RF VTVM	IF	Q7 (E)	AF-GEN	TC1	Adjust for mini- mum.	
15. S meter 1) Starting level 2) S1 3) S9	RF GAIN: Fully counter- clockwise				IF	VR2	Set to starting level.	
	BAND:14 VFO:175 MODE:CW SSG:14.175M, 8dB					T5	Set to S1.	T5 should be adjusted while it is turned counterclockwise.
	SSG:14.175M, 40dB					VR2	Set to S9.	
16. Counter standard Oscillator	BAND:10 VFO:0 Receive WWV signal.				Counter	TC1	Set to zero beat.	

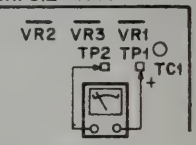
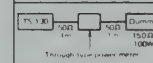
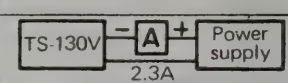
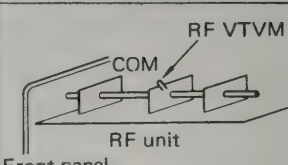
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks		
		Instruments	Unit	Terminal	Unit	Parts	Reference			
17. Base current 1) S type	MODE:SSB MIC GAIN: Full counter- clockwise DC current meter:Conne- ct ⊕ to D14 lead, ⊖ to D14 terminal. STBY:SEND	DC curre- nt meter	Final	D14	Final	VR1	150mA			
	STBY:REC								F14 3P ter- minal	VR2
	DC current meter:Connect ⊖ to red wire from F14 ter- minal, ⊕ to 3P terminal. STBY:SEND									
	STBY:REC									
	2) V type	DC current meter:Conn- ect ⊕ to 14A, ⊖ to D2 side. STBY:SEND	DC curre- nt meter	Final	14A	Final	VR1		100mA	
		STBY:REC								
18. Carrier level	BAND:14 MODE:CW STBY:SEND Reduce RF power(S type) to 30W, RF meter(V type) to 3 by CAR level control. STBY:REC	Power meter			AF-GEN RF	T2 T4	Adjust for maxi- mum RF output.			
19. ALC (RF power) 1) S type	BAMD:14 CAR LEVEL: Centered VFO:200 MODE:CW STBY:SEND Filter unit, VR2:Counter- clockwise	Power meter			Filter	VR3	Set to 95W.			
	BAND:28.5									
	2) V type					Same as above.				Filter
20. RF meter (V type only)	BAND:14 MODE:CW Meter:RF(IC) STBY:SEND	Power meter			Filter	VR1	Set to 8W.			
	STBY:REC									
21. IC meter (S type only)	MODE:CW DC current meter:Conne- ct ⊖ to red wire from F14 terminal ⊕ to 3P ter- minal. STBY:SEND	Power meter, DC curr- ent meter			Filter	VR4	Set to 11A on IC meter.			
	STBY:REC									

ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
22. Protection 1) S type	Filter unit, VR1: Fully clockwise BAND:14 MODE: CW ANT: Power meter (50Ω) STBY: SEND	DVM, power meter (50Ω)	Filter	TP1 TP2	Filter	TC1	Adjust for mini- mum.	Approx. 0.2~0.4V 
2) V type	 150Ω, 100W Dummy load					VR1	Adjust VR1 to obtain 39W RF power.	
	Filter unit, VR1: Fully clockwise BAND:14 MODE: CW ANT: 50Ω Dummy STBY: SEND		Filter	TP1 TP2	Filter	TC1	Adjust for mini- mum.	Approx. 40~50mV.
	STBY: REC							
	ANT: Shorted STBY: SEND STBY: REC	DC curre- nt meter			Filter	VR2	Set to 2.3A.	
23. TX spurious	BAND:21 VFO:250 MODE:SSB MIC,CAR level: Fully counter- clockwise STBY: SEND STBY: REC	RF VTVM	RF	Common terminal of rotary switch	RF	VR1	Adjust for mini- mum.	
24. SSB carrier point	BAND:14 MIC input: AG 1.5kHz, 7mV MODE:SSB STBY: SEND 1) Adjust MIC GAIN control until RF pow- er becomes 50 W(S type), 5W (V type). 2) Change AG frequency to 300Hz and 2.7kHz alter- nately. MODE:SSB and REV	Power meter, Synchro- scope, AG			CAR	TC1 (SSB) TC2 (REV)	Adjust TC1 and TC2 so that RF power is equal at AG frequency 300Hz and 2.7 kHz.	Within -6dB at AG frequency 400Hz and 2.6kHz respect to 1.5kHz signal level.
25. Carrier suppression Note: This ad- justment should be done after completing the SSB carrier point adjust- ment (or check) in item 24.	BAND:14 MODE: CW↔ SSB, REV STBY: SEND MIC: No input STBY: REC	Power meter, Oscillo- scope		ANT	AF-GEN	VR5 TC2	Adjust VR5 and TC2 alternately for minimum output.	Carrier better than 40dB down from output signal.
26. Speech processor	MODE:SSB MIC input: AG 1kHz, 10mV PROC: ON↔OFF	AF VTVM	Processor	TP1	Processor	VR2	Adjust for equal level.	Approx. 150mV
27. Side tone	MODE: CW AF GAIN: 12:00 KEY: Plug a key and operate.	AF VTVM, KEY		SP	AF-GEN	VR4	Set to 0.63V/8Ω.	

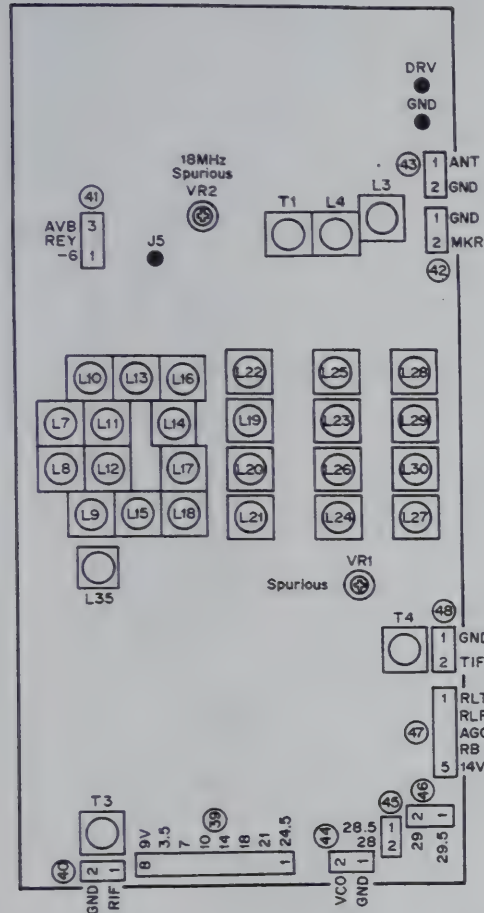
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
22. Protection 1) S type	Filter unit, VR1: Fully clockwise BAND:14 MODE: CW ANT: Power meter (50Ω) STBY: SEND	DVM, power meter (50Ω)	Filter	TP1 TP2	Filter	TC1	Adjust for mini- mum.	Approx. 0.2~0.4V 
	 150Ω, 100W Dummy load					VR1	Adjust VR1 to obtain 39W RF power.	
	Filter unit, VR1: Fully clockwise BAND:14 MODE: CW ANT: 50Ω Dummy STBY: SEND		Filter	TP1 TP2	Filter	TC1	Adjust for mini- mum.	Approx. 40~50mV.
	STBY: REC							
	ANT: Shorted STBY: SEND STBY: REC	DC curren- t meter			Filter	VR2	Set to 2.3A.	
23. TX spurious	BAND:21 VFO:250 MODE:SSB MIC, CAR level: Fully counter- clockwise STBY: SEND STBY: REC	RF VTVM	RF	Common terminal of rotary switch	RF	VR1	Adjust for mini- mum.	
24. SSB carrier point	BAND:14 MIC input: AG 1.5kHz, 7mV MODE:SSB STBY:SEND 1) Adjust MIC GAIN control until RF pow- er becomes 50 W(S type), 5W (V type). 2) Change AG frequency to 300Hz and 2.7kHz alter- nately. MODE:SSB and REV	Power meter, Synchro- scope, AG			CAR	TC1 (SSB) TC2 (REV)	Adjust TC1 and TC2 so that RF power is equal at AG frequency 300Hz and 2.7 kHz.	Within -6dB at AG frequency 400Hz and 2.6kHz respect to 1.5kHz signal level.
25. Carrier suppression Note: This ad- justment should be done after completing the SSB carrier point adjust- ment (or check) in item 24.	BAND:14 MODE: CW↔ SSB, REV STBY: SEND MIC: No input STBY: REC	Power meter, Oscillo- scope		ANT	AF-GEN	VR5 TC2	Adjust VR5 and TC2 alternately for minimum output.	Carrier better than 40dB down from output signal.
26. Speech processor	MODE:SSB MIC input: AG 1kHz, 10mV PROC: ON↔OFF	AF VTVM	Processor	TP1	Processor	VR2	Adjust for equal level.	Approx. 150mV
27. Side tone	MODE: CW AF GAIN: 12:00 KEY: Plug a key and operate.	AF VTVM, KEY		SP	AF-GEN	VR4	Set to 0.63V/8Ω.	

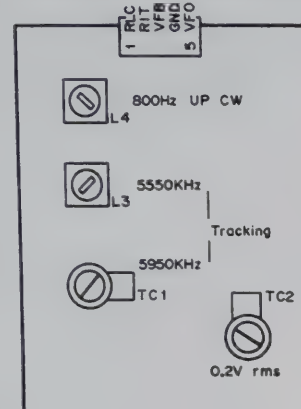
ADJUSTMENTS

PC BOARD ALIGNMENT

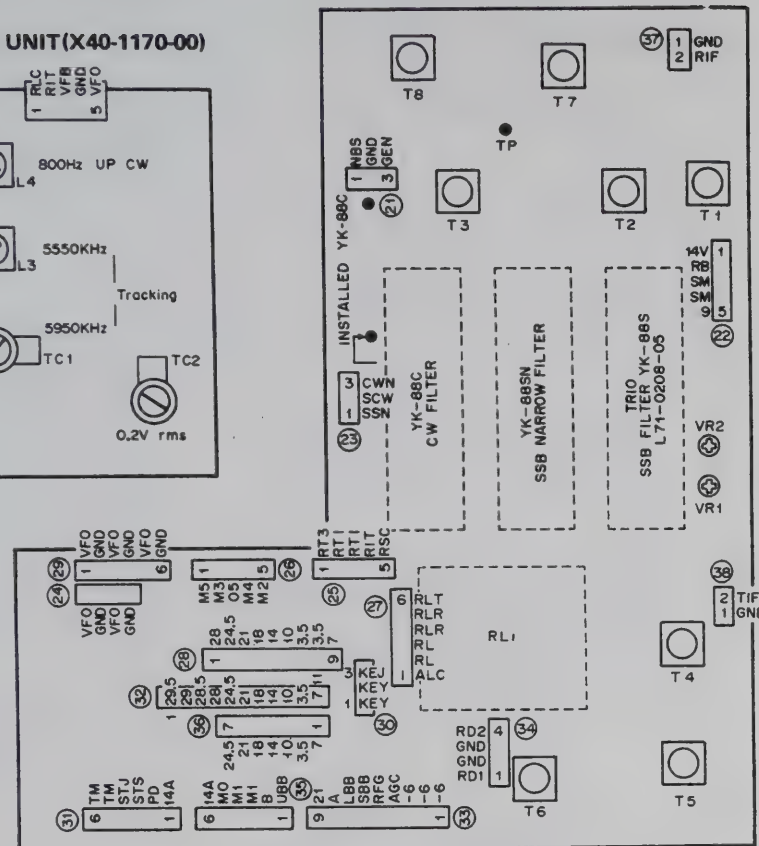
▼ RF UNIT (X44-1380-00)



▼ VFO UNIT (X40-1170-00)

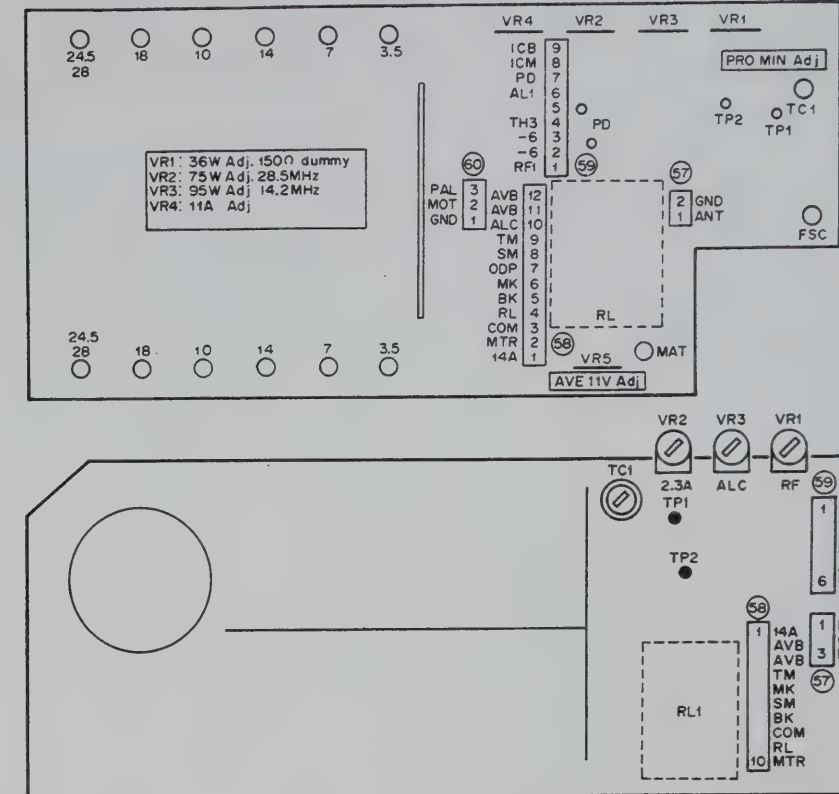


▼ IF UNIT (X48-1300-00)

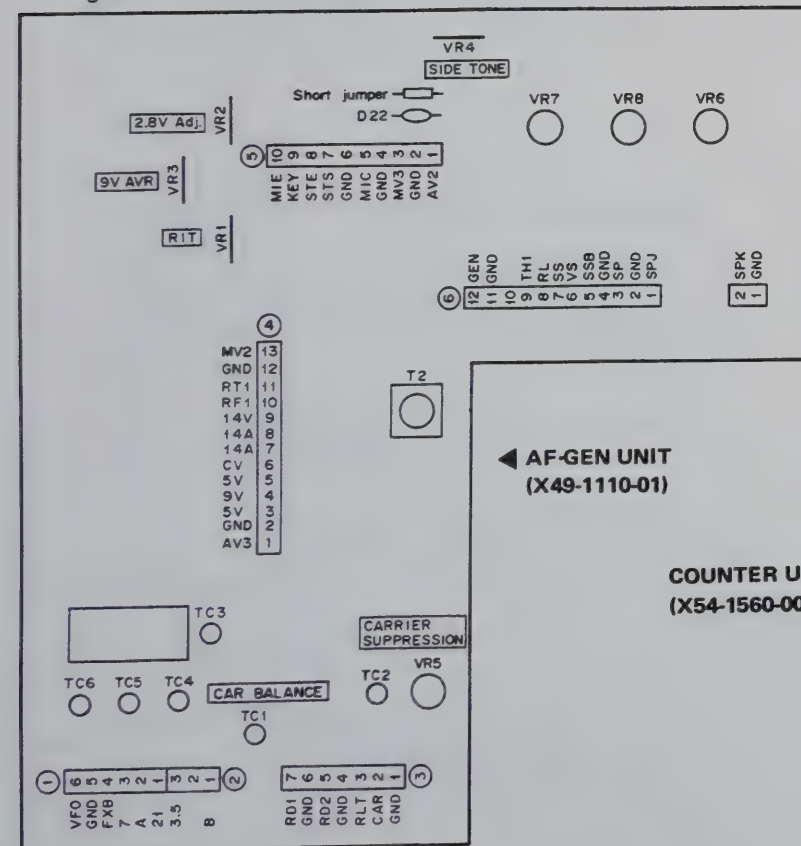


ADJUSTMENTS

▼ FILTER UNIT (X51-1240-00) S TYPE

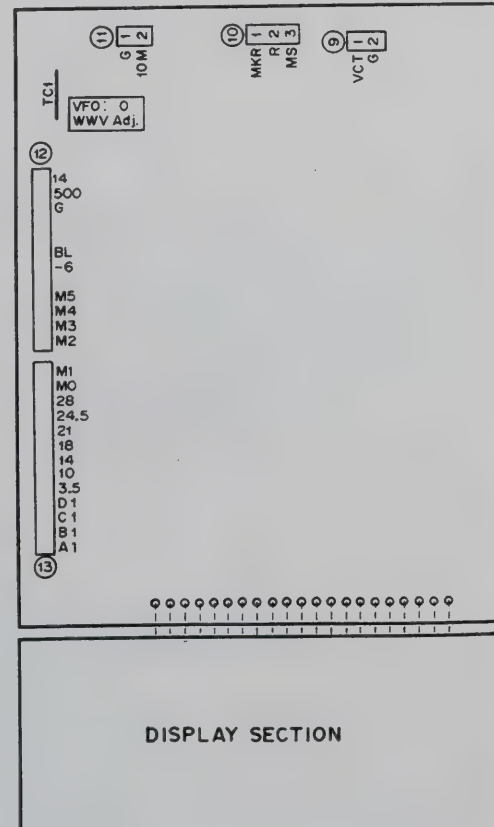


◀ FILTER UNIT (X51-1250-00) V TYPE



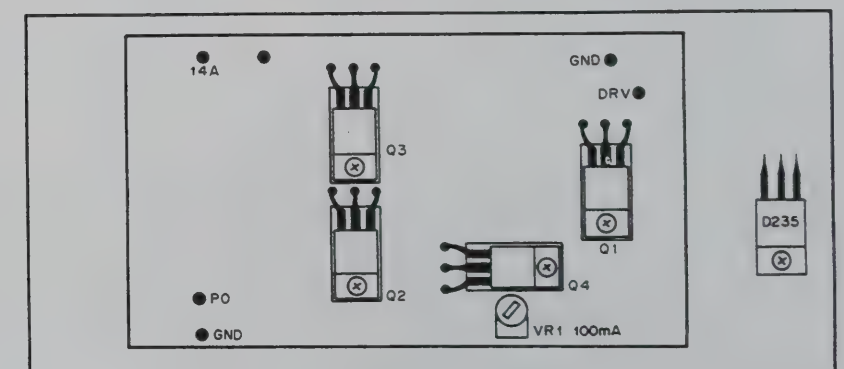
◀ AF-GEN UNIT (X49-1110-01)

COUNTER UNIT (X54-1560-00)

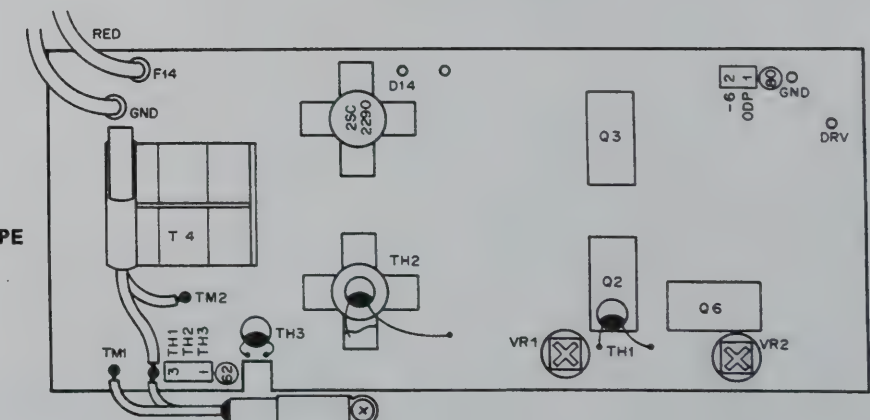


DISPLAY SECTION

FINAL UNIT (X56-1300-00) V TYPE

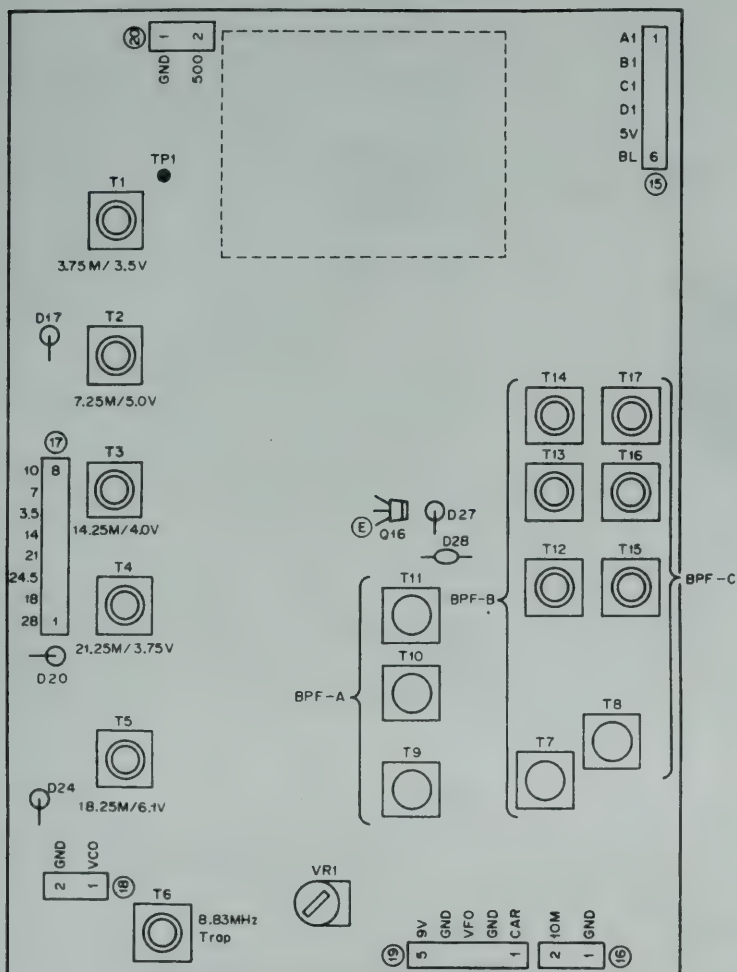


FINAL UNIT (X56-1350-00) S TYPE

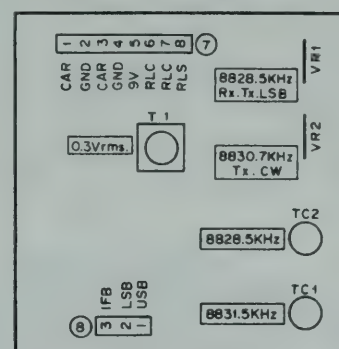


ADJUSTMENTS

▼ PLL UNIT (X50-1700-00)



▼ CAR UNIT (X50-1500-00)



TEST AND ALIGNMENT SET-UP

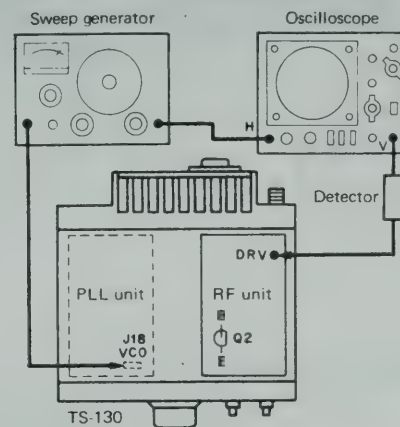


Fig. 4 7. TX BPF (RX BPF)

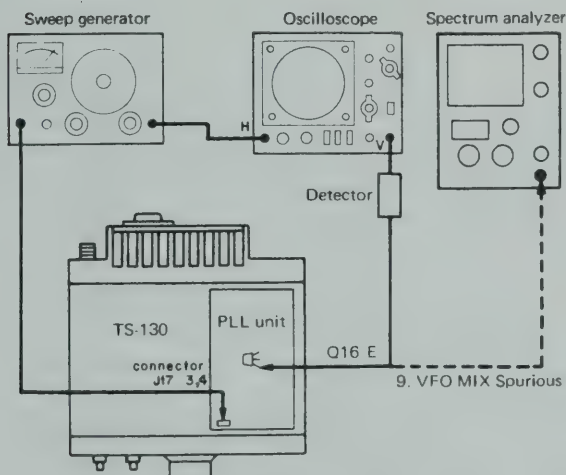


Fig. 5 8. PLL BPF-A,B,C
9. VFO MIX spurious (Disconnect Sweep generator and Oscilloscope)

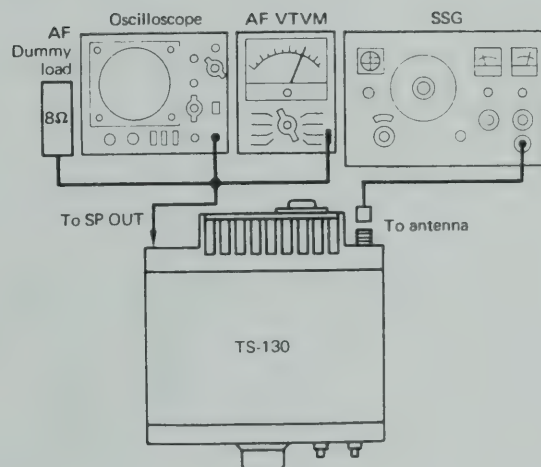
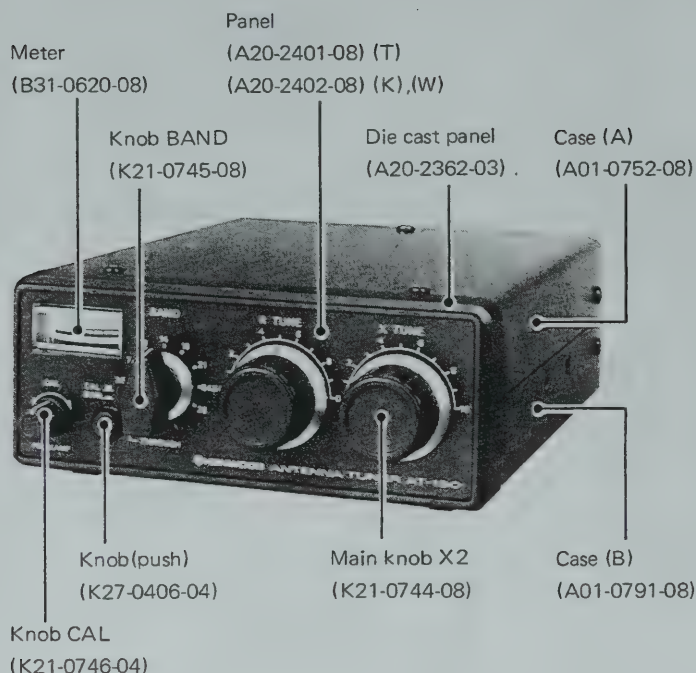


Fig. 6 11. IF AMP, 12. IF trap

AT-130

OUTSIDE VIEW



SPECIFICATIONS

1. Antenna Coupler

Frequency range	.8 amateur bands from 3.5 to 29.7 MHz
Input impedance	.50Ω
Output impedance	.20 to 300Ω, unbalanced.
Through power	.150W max. (3.5 MHz band, 120W)
Insertion loss	.Less than 0.5dB at optimum match.

2. SWR Meter

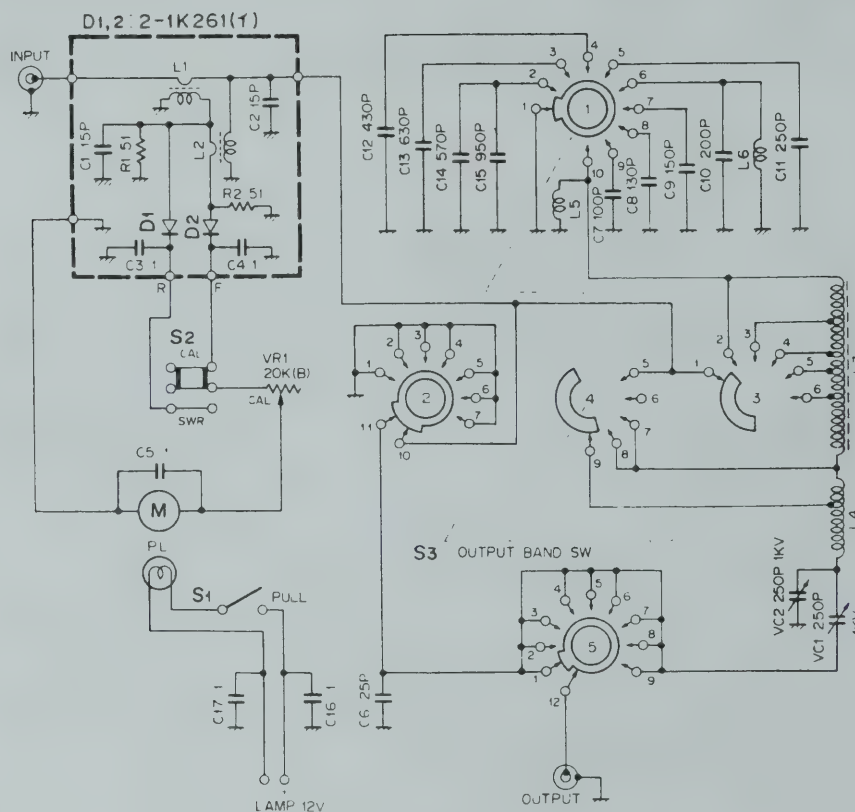
Frequency range	.3.5 to 29.7MHz
Max. power	.150W
Measurable range	.1.0:1 to 10:1
Min. power required	.2W

3. General

INPUT Connector	.UHF type (50Ω)
ANT Connector	.UHF type (50Ω)
GND	.Wing nut and STUD.
Dimensions	.H. 60mm (2-3/8")
	.W. 152mm (6")
	.D. 159mm (6-1/4")
Weight	.1.6kg (3.5 lbs) approx.

NOTE: The circuit and ratings may change without notice due to developments in technology.

SCHEMATIC DIAGRAM

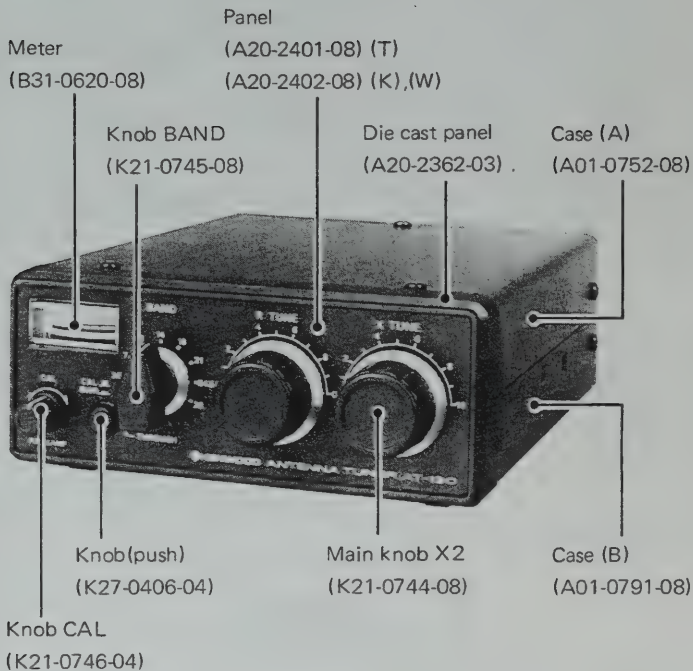


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AT-130

OUTSIDE VIEW



SPECIFICATIONS

1. Antenna Coupler

Frequency range	.8 amateur bands from 3.5 to 29.7 MHz
Input impedance	.50 Ω
Output impedance	.20 to 300 Ω , unbalanced.
Through power	.150W max. (3.5 MHz band, 120W)
Insertion loss	.Less than 0.5dB at optimum match.

2. SWR Meter

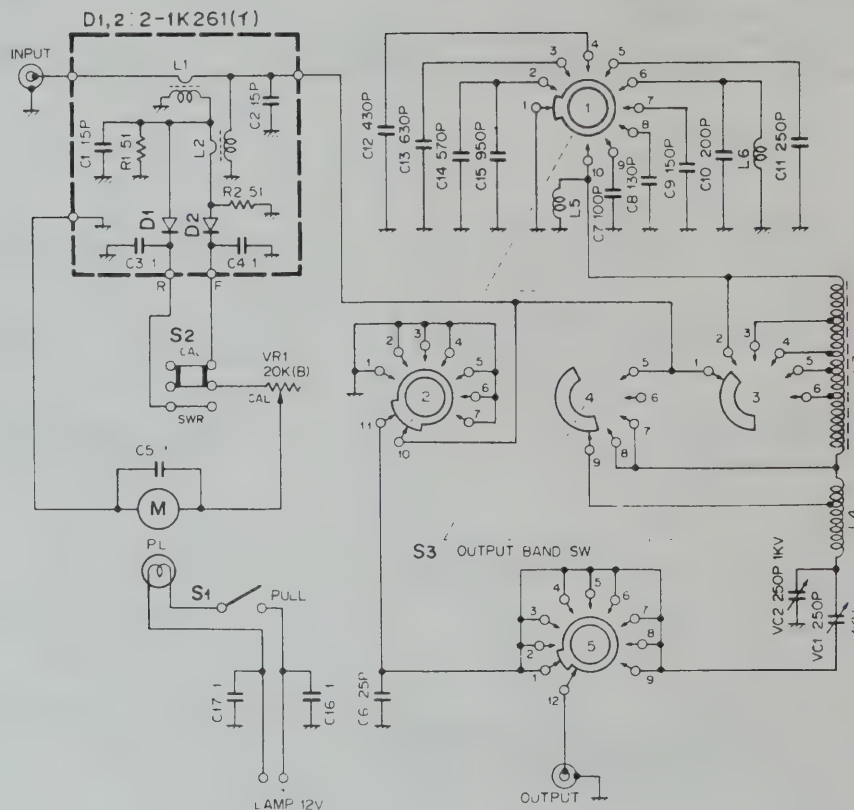
Frequency range	.3.5 to 29.7MHz
Max. power	.150W
Measurable range	.1.0:1 to 10:1
Min. power required	.2W

3. General

INPUT Connector	.UHF type (50 Ω)
ANT Connector	.UHF type (50 Ω)
GND	.Wing nut and STUD.
Dimensions	.H. 60mm (2-3/8") W. 152mm (6") D. 159mm (6-1/4")
Weight	.1.6kg (3.5 lbs) approx.

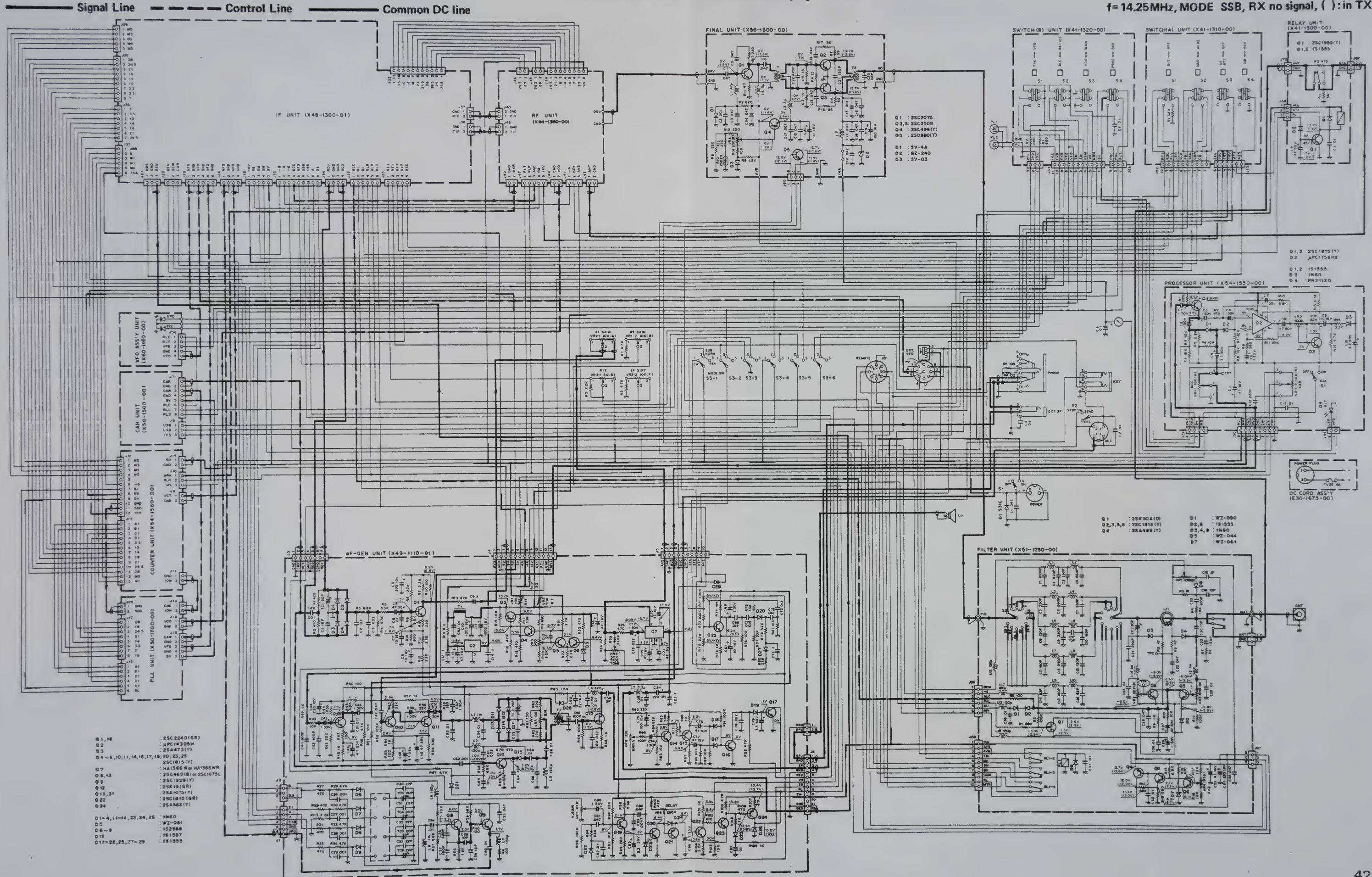
NOTE: The circuit and ratings may change without notice due to developments in technology.

SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM (V) TYPE

Voltage measurement conditions
f=14.25MHz, MODE SSB, RX no signal, () : in TX



AT-130 / VFO-120

AT-130 PARTS LIST

☆: New parts

Ref.No.	Parts No.	Description	Re- marks
GENERAL			
	A01-0752-08	Case (A)	
	A01-0791-08	Case (B)	☆
	A20-2362-03	Die cast panel	
	A20-2401-08	Panel (T)	☆
	A20-2402-08	Panel (K),(W)	☆
	B31-0620-08	Meter	
	B46-0058-00	Warranty card (K)	
	B50-2764-08	Operating manual (K),(W)	☆
	B50-2765-08	Operating manual (T)	☆
VC1,2	C02-0014-08	Variable capacitor 250pF 1kV	
C6	CM93B2H250J	MC 25pF 500V	
C7	CM93B2H101J	MC 100pF 500V	
C8	CM93B2H131J	MC 130pF 500V	
C9	CM93B2H151J	MC 150pF 500V	
C10	CM93B2H201J	MC 200pF 500V	
C11	CM93B2H251J	MC 250pF 500V	
C12	CM93B2H431J	MC 430pF 500V	
C13	CM93B2H631J	MC 630pF 500V	
C14	CM93B2H571J	MC 570pF 500V	
C15	CM93B2H951J	MC 950pF 500V	
	D23-0061-04	Bearing	
	E04-0102-05	UHF type receptacle	
	E08-0203-25	2P socket	
	E09-0203-25	2P plug	
	E23-0015-04	Earth lug	
	H01-2726-08	Carton case (T)	☆
	H01-2727-08	Carton case (K),(W)	☆
	H12-0461-08	Cushion	
	J02-0069-05	Foot	
	J29-0402-08	Angle	
	J42-0401-04	Knob bush	
	K21-0744-08	Main knob	
	K21-0745-08	Knob BAND	
	K21-0746-04	Knob CAL	
	K27-0406-04	Knob Push	
L3	L34-2003-08	Tuning coil	☆
L4	L34-2002-08	Tuning coil	☆
L5,6	L34-0849-08	Coil	
	N09-0630-08	Wing screw	☆
	N14-0509-05	Wing nut GND	☆
	N19-0620-08	Nylon washer	☆
VR1	R05-3406-08	Pot. 20k Ω (B) CAL	
S1	S40-2403-05	Push switch Lamp	☆
S3	S01-5405-08	Rotary switch BAND	☆
	X41-1280-00	Detector unit	☆

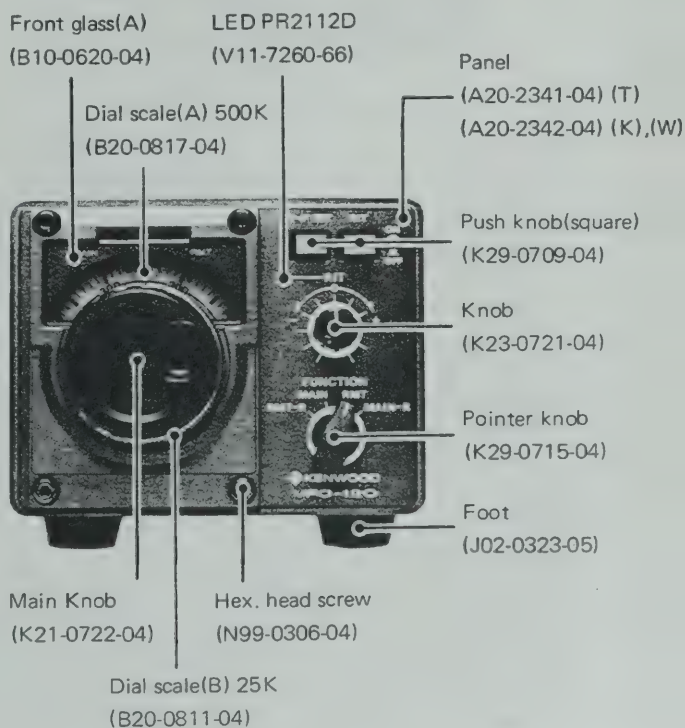
Ref.No.	Parts No.	Description	Re- marks
DETECTOR UNIT (X41-1280-00)			
C1,2	CM93B2H150J	MC 15pF 500V	
L1,2	L39-0403-08	Pick up coil	
D1,2	V11-7763-26	Diode 2-1K261	

VFO-120 SPECIFICATIONS

Oscillator frequency 5.50~6.00MHz
Oscillator circuit Clapp
Output voltage 0.2V \pm 1dB(across 470-ohm load)
Frequency stability Within 100Hz per 30 minutes after 3 minutes warm-up (at room temperature).
Solid-state complement FET : 2
Transistor : 2
Diode : 6
Power source From TS-120/TS-130
Dimensions 123(4-7/8)W X 96(3-13/16) H-X 235(9-1/4) D mm (inches)
Weight 2.5kg(3.5lbs)

NOTE: The circuit and ratings may change without notice due to developments in technology

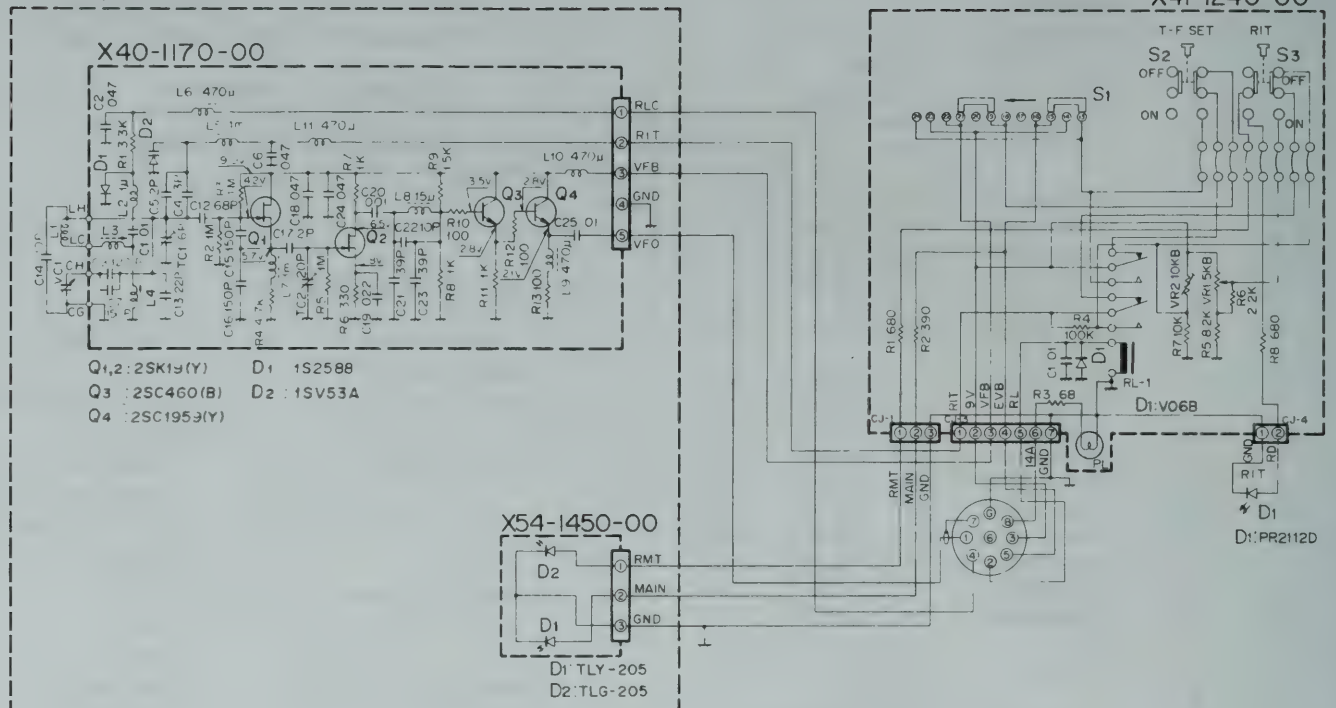
VFO-120 OUTSIDE VIEW



VFO-120

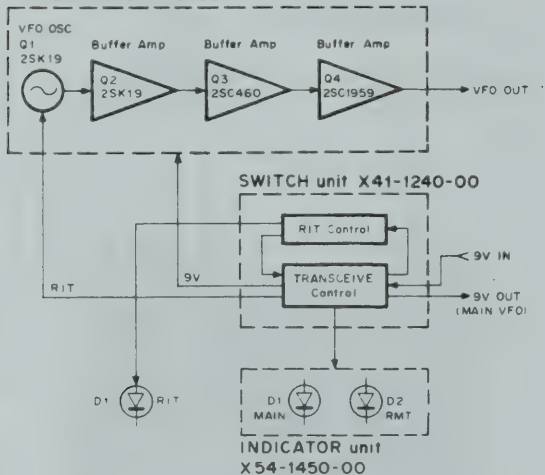
SCHEMATIC DIAGRAM

X60-1160-01



BLOCK DIAGRAM

VFO unit X40-1170-00



PARTS LIST

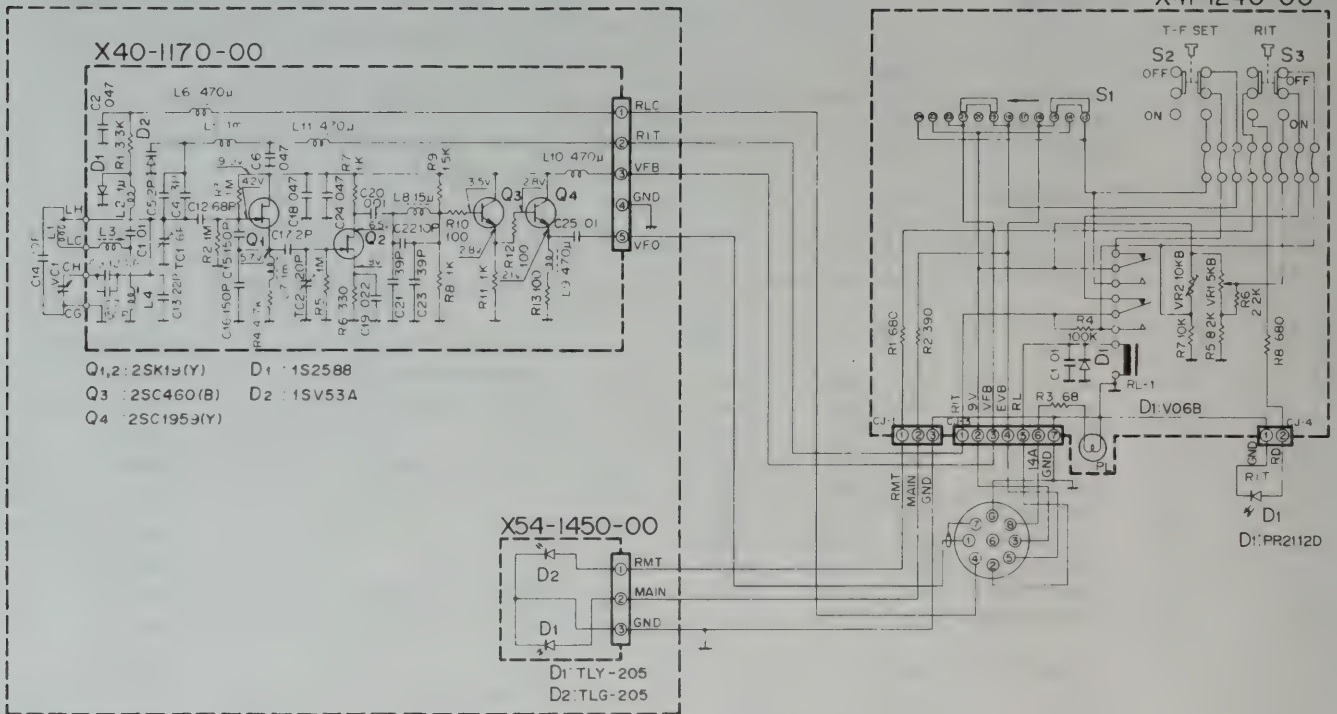
☆: New parts

Ref.No.	Parts No.	Description	Re- marks
GENERAL			
	A01-0739-03	Case(A) upper	
	A01-0740-03	Case(B) lower	
	A20-2341-04	Panel	(T)
	A20-2342-04	Panel	(K),(W)
	B39-0407-04	Spacer for foot	
	B46-0058-00	Warranty card	(K)
	B50-2633-10	Operating manual	(K),(W) ☆
	B50-2634-10	Operating manual	(T) ☆
	E02-0107-05	Diode socket	
	E06-0852-05	8P DIN socket	
	E30-1623-05	Earth cable	
	E30-1628-15	VFO cable	☆
	E31-0482-15	Connector with lead	
	G09-0405-05	Spring	
	H01-2609-04	Carton case (inside)	(K),(W)
	H01-2610-04	Carton case (inside)	(T)
	H10-2513-02	Packing fixture (F)	
	H10-2514-02	Packing fixture (R)	
	H12-0445-04	Cushion	
	H20-1407-03	Protective cover	
	H25-0117-04	Accessories bag 80 X 250	

VFO-120

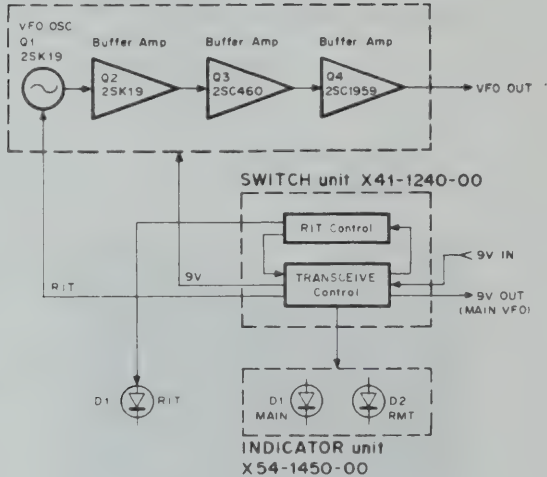
SCHEMATIC DIAGRAM

X60-1160-01



BLOCK DIAGRAM

VFO unit X40-1170-00



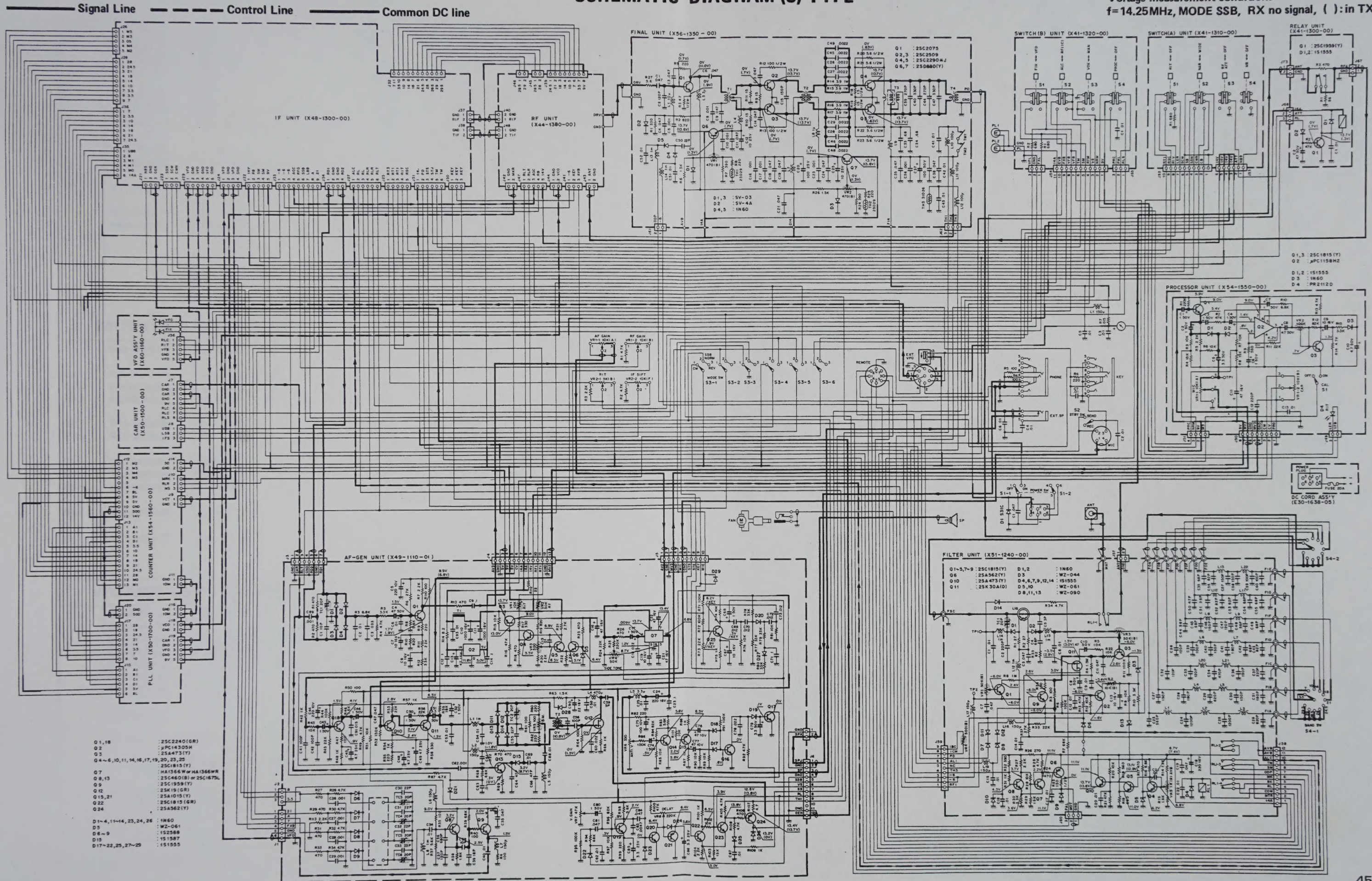
PARTS LIST

☆: New parts

Ref.No.	Parts No.	Description	Re- marks
GENERAL			
	A01-0739-03	Case(A) upper	
	A01-0740-03	Case(B) lower	
	A20-2341-04	Panel	(T)
	A20-2342-04	Panel	(K),(W)
	B39-0407-04	Spacer for foot	
	B46-0058-00	Warranty card	(K)
	B50-2633-10	Operating manual	(K),(W) ☆
	B50-2634-10	Operating manual	(T) ☆
	E02-0107-05	Diode socket	
	E06-0852-05	8P DIN socket	
	E30-1623-05	Earth cable	
	E30-1628-15	VFO cable	☆
	E31-0482-15	Connector with lead	
	G09-0405-05	Spring	
	H01-2609-04	Carton case (inside)	(K),(W)
	H01-2610-04	Carton case (inside)	(T)
	H10-2513-02	Packing fixture (F)	
	H10-2514-02	Packing fixture (R)	
	H12-0445-04	Cushion	
	H20-1407-03	Protective cover	
	H25-0117-04	Accessories bag 80 X 250	

SCHEMATIC DIAGRAM (S) TYPE

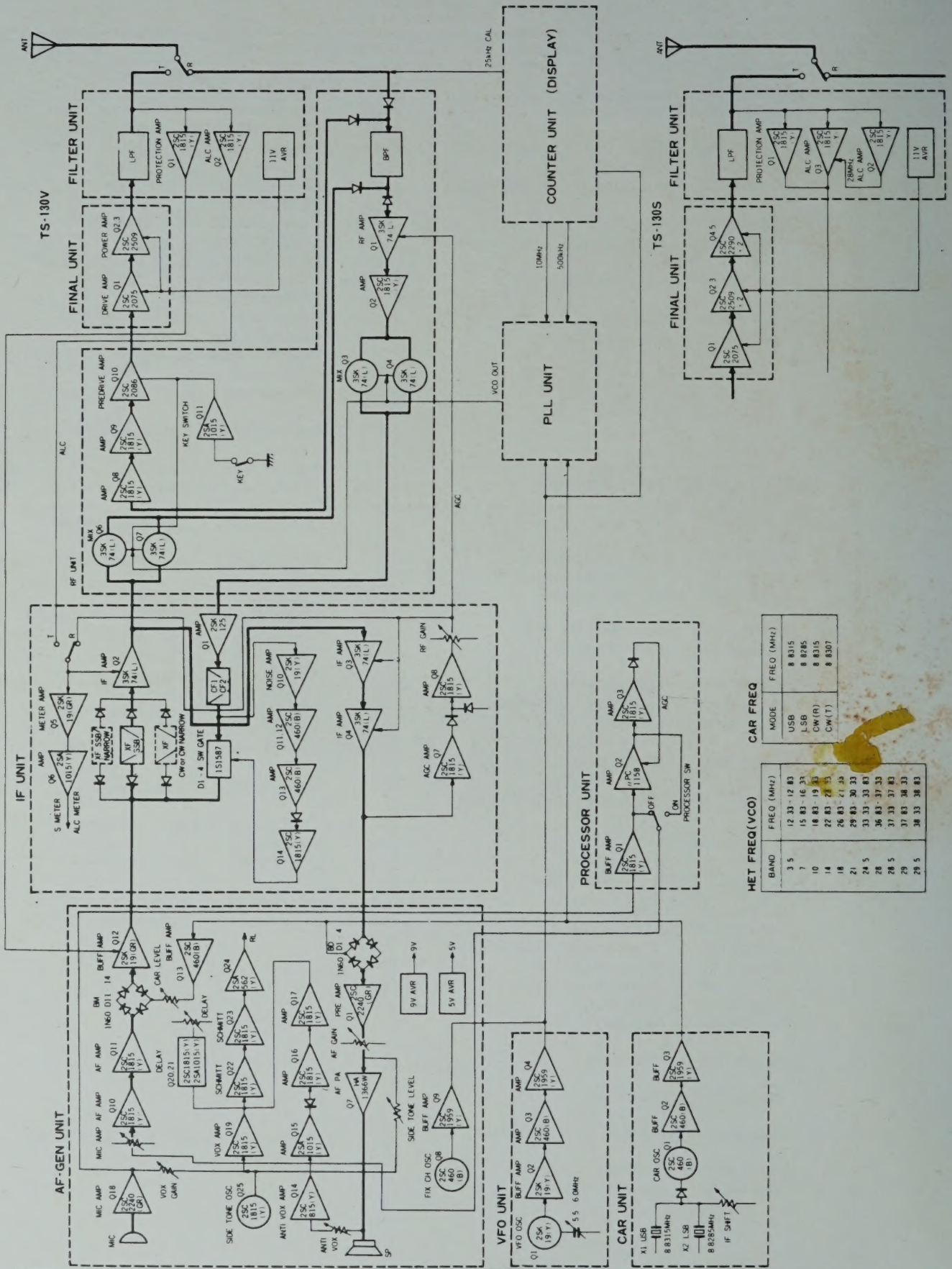
Voltage measurement conditions
 $f = 14.25\text{MHz}$, MODE SSB, RX no signal, () : in TX



VFO-120

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
D1	J02-0323-05	Foot	☆	VFO UNIT (X40-1170-00)			
	J02-0409-04	Assistance foot		C2	C91-0456-05	C 0.047 μ F 25V	☆
	J61-0019-05	Vinyle tie		C4	CC45RG1H030C	C 3pF ± 0.25 pF	
	K23-0721-04	Knob RIT		C5	CC45PG1H020C	C 2pF ± 0.25 pF	
	K29-0709-04	Push knob (square)		C6	C91-0456-05	C 0.047 μ F 25V	
	K29-0715-04	Pointer knob FUNCTION		C7	CC45LG1H151J	C 150pF	
	N14-0509-05	Wing nut		C9	CC45LG1H121J	C 120pF	
	N99-0306-04	Hex. head screw (VFO M4X10)		C12	CC45LG1H680J	C 68pF	
	V11-7260-66	LED PR2112D RIT		C13	CC45LG1H220J	C 22pF	
	X41-1240-00	Switch unit		C14	CC45CG1H100D	C 10pF ± 0.5 pF	
	X60-1160-01	VFO ass'y unit		C15,16	CC45LG1H151J	C 150pF	
SWITCH UNIT (X41-1240-00)				C17	CC45CH1H020C	C 2pF ± 0.25 pF	
	B30-0818-05	Pilot lamp		C18	C91-0456-05	C 0.047 μ F 25V	
CJ-1	E40-0373-05	Mini connect wafer 3P		C21	CC45SL1H390J	C 39pF	
CJ-3	E40-0774-05	Mini connect wafer 7P		C22	CC45CH1H100D	C 10pF ± 0.5 pF	
CJ-4	E40-0274-05	Mini connect wafer 2P		C23	CC45SL1H390J	C 39pF	
VR1	R01-2404-05	Pot. 5k Ω (B) RIT		C24	C91-0456-05	C 0.047 μ F 25V	
VR2	R12-3025-05	Pot. 10k Ω (B)			C02-0019-05	Variable capacitor	☆
S1	S29-1410-05	Slide rotary switch		TC1	C05-0009-15	Ceramic trimmer 6pF	
S2	S40-2409-15	Push switch T-F SET		TC2	C05-0013-15	Ceramic trimmer 20pF	
S3	S40-2404-05	Push switch RIT			D40-0614-05	Dial mechanism ass'y	☆
RL1	S51-2408-05	Relay G2V-2			E40-0574-05	Mini connect wafer 5P	
D1	V11-0219-05	Diode V06B		L1	L32-0628-05	OSC coil	☆
VFO ASS'Y UNIT (X60-1160-01)				L2	L33-0025-05	Choke coil 1 μ H	
	B01-0621-04	Dial escutcheon	☆	L3	L32-0629-05	OSC coil (C)	☆
	B08-4301-04	Dial back board		L4	L32-0609-05	OSC coil (B)	
	B10-0620-04	Front glass (A) MAIN-RMT		L5	L40-1021-03	Ferri-inductor 1mH	
	B20-0811-04	Dial scale (B) 25K		L6	L40-4711-03	Ferri-inductor 470 μ H	
	B20-0817-04	Dial scale (A) 500K	☆	L7	L40-1021-03	Ferri-inductor 1mH	
	B42-1645-04	Seal bottom		L8	L40-1501-03	Ferri-inductor 15 μ H	
	B42-1671-04	Seal top		L9~11	L40-4711-03	Ferri-inductor 470 μ H	
	G01-0840-04	Coil spring			R92-0150-05	Short jumper	
	K21-0722-04	Main knob		Q1,2	V09-0011-05	FET 2SK19(Y)	
	N19-0608-04	Washer Main knob		Q3	V03-0079-05	TR 2SC460(B)	
	X40-1170-00	VFO unit		Q4	V03-1959-06	TR 2SC1959(Y)	
	X54-1450-00	Indicator unit		D1	V11-0414-05	Diode 1S2588	
				D2	V11-4161-36	Varicap diode 1SV53A	
INDICATOR UNIT (X54-1450-00)				D1	V11-3163-16	LED TLY-205 MAIN	
				D2	V11-3162-86	LED TLG-205 RMT	

BLOCK DIAGRAM



CAR FREQ

MODE	FREQ (MHz)
USB	8.8315
LSB	8.8285
CW (R)	8.8315
CW (T)	8.8307

HET FREQ (VCO)

BAND	FREQ (MHz)
3 S	12.33 - 12.83
7	15.83 - 16.33
10	18.83 - 19.33
14	22.83 - 23.33
18	26.83 - 27.33
21	29.83 - 30.33
24	33.33 - 33.83
28	36.83 - 37.33
28 S	37.33 - 37.83
29	37.83 - 38.33
29 S	38.33 - 38.83